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ERRATA

VOLUME XVI

page 561	line 45	for '*Typha elephantina*' read '*Pennisetum purpureum*'
572	33	for '*Leucaena pulverulenta*' read '*Albizzia jubibrissin*'

VOLUME XVIII

2	46	for 'Lumber' read 'Limber'
40	32	for 'Noak' read 'Noack'
73	22	for '*P. strobi* (*C. ribicola*),' read 'and *P. strobi* (*C. ribicola*).'
89	39	for '(*Amomum subulatum*)' read '[*Elettaria cardamomum*]'
137	1	for 's'Jacob (S. C.)' read 's'Jacob (J. C.)'
170	47	for '*U. panici-miliacei*' read '*Sphacelotheca sorghi*'
	48	for '*Panicum miliaceum*' read '*Sorghum* sp.'
178	8	for '*potroni*' read '*potronii*'
233	32	for '*Amomum subulatum*' read '*Elettaria cardamomum*'
	35	for '*Elletaria cardamomum*' read '*Amomum subulatum*'
270	33	for '*Acerotagallia*' read '*Aceratagallia*'
274	15	for '*Typha elephantina*' read '*Pennisetum purpureum*'
284	21	for 'Garren (K. M.).' read 'Garren (K. H.).'
315	10	for '*fasciculatis*' read '*fasciculatus*'
	14	insert 'n.sp.' after '*humuli*'
	40	for '*oyxsporum*' read '*oxysporum*'
321	23	for '(?) *copallina*' read '*glabra*'
379	47	for 'xvii' read 'xviii'
389	21	insert 'subsequent' before 'appearance'
	23	for 'and the first pustules' read 'but pustules subsequently'
446	10	for '*Bacterium*' read '*Bacterium tumefaciens*'
452	9	for 'xiv' read 'xvi'
468	46	for 'xii' read 'xxii'
487	13	for 'Davidson (W.)' read 'Davidson (R. W.)'
504	43	for '*juranum*' read '*juruanum*'
506	5	for 'Eastern' read 'Easter'
517	23	for '*ehrenbergi*' read '*ehrenbergii*'
	36	for '444' read '472'
523	22	for '*ectoendothrix*' read 'ecto-endothrix type'
	34	for '*endoectothrix*' read 'ecto-endothrix type'
533	8	for '*J.*' read '*G.*'
551	42	delete '*claytoniana*'
573	4	for 'are' read ', one'
625	32	for '*Himatia*' read '*Himantia*'
655	35	for '*hypolaterita*' read '*hypolateritia*'
689	4	for 'perithecia' read 'conidia'
726	19	for '43' read '431'
792	6	for 'increased' read 'decreased'
822	14	for '*Elettaria cardamomum*' read '*Amomum subulatum*'

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IMPERIAL MYCOLOGICAL INSTITUTE

REVIEW
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VOL. XVIII JANUARY 1939

PASSAVALLI (L. P.). **I Castagneti da frutto in Toscana e nell' Emilia. (Cause del loro deperimento e possibilità di migliorarli.)** [The edible Chestnut groves in Tuscany and Emilia. (Causes of their dying-off and the possibility of improvement.)]—*Alpe*, xxv, 4, pp. 106–117, 5 figs., 1938.

The writer summarizes and discusses the rapidly deteriorating economic position of the edible chestnut industry in Tuscany and Emilia, and suggests a number of technical and cultural measures for its improvement, including the extended cultivation of the Shiba and Tamba Japanese varieties, resistant to ink disease [*Phytophthora cambivora*: *R.A.M.*, xvii, p. 637], which is stated to be present in groves covering an area of 1,024 hect. in the province of Bologna alone.

BUCHWALD (N. F.). **Om Angreb af Kulsvamp (Ustulina vulgaris) paa Lind (Tilia vulgaris).** [On the infection of Lime (*Tilia vulgaris*) by the coal fungus (*Ustulina vulgaris*).]—*Dansk Skovforen. Tidsskr.*, *1938*, pp. 239–243, 1938.

Evidence is briefly adduced for the occurrence of *Ustulina vulgaris* in a parasitic form on old lime (*Tilia vulgaris*) trees [*R.A.M.*, xv, p. 471] in a park avenue at Holsteinborg, Denmark. The mycelium of the fungus was isolated in pure culture from several of the specimens. *U. vulgaris* produces a typical white rot and is believed to enter the trees through wounds inflicted during the operation of lopping adventitious basal shoots; this means of ingress should be barred by the application to the cut surfaces of carbolineum or some similar fungicidal substance.

PONOMAREFF (N. V.). **The conidial stage of Hypoxylon pruinatum.**—*Phytopathology*, xxviii, 7, pp. 515–518, 2 figs., 1938.

The conidial stage of *Hypoxylon pruinatum*, the agent of a destructive canker of aspens (*Populus tremuloides*) [*R.A.M.*, ix, p. 421] in Minnesota and other Lake States, is stated to have been hitherto known only in culture and is here described on the basis of an examination of material either naturally diseased or infected as a result of inoculation with ascospore cultures. A few weeks after invasion the fungus forms a subiculum on the surface of the cortex and within three months conidial fructifications begin to appear on this subiculum, still covered by periderm. At first they comprise compact, coremium-like tufts of

dichotomously branched conidiophores, 75 to 150 μ in length, but they gradually become stromatic in texture, and measure 1·5 by 0·85 mm. The apices responsible for breaking the periderm are sterile, but on all other parts of the stromata and subiculum fertile conidiophores develop. The stromata soon fall off, leaving only minute, jagged remnants and circular scars. By the time the perithecial stromata are produced, practically all trace of the conidial fructifications has disappeared, so that previous failures to recognize the imperfect stage are not surprising. The conidia formed at the geniculate ends of the terminal conidiophore branches are hyaline, unicellular, fusiform to elliptical, 5·5 to 6·7 by 2 to 3 μ, and germinate readily on malt agar.

Wilkins (W. H.), Harley (J. L.), & Kent (G. C.). **The ecology of the larger fungi. II. The distribution of the larger fungi in part of Charlton Forest, Sussex.**—*Ann. appl. Biol.*, xxv, 3, pp. 472–489, 1 diag., 1938.

In this second contribution to their study of the ecological relationships of the larger fungi [*R.A.M.*, xvii, p. 278], the authors record the results of their examination of the fungi found in a plateau beech wood on the South Downs in Sussex towards the end of the summer of 1932, in relation to the type of the surrounding vegetation, and nature and reaction of the soil. Useful information on the factors affecting the distribution of certain species can be deduced from the results obtained, the co-ordination of which, however, is not attempted as the data are inadequate.

Hirt (R. R.) & Eliason (E. J.). **The development of decay in living trees inoculated with Fomes pinicola.**—*J. For.*, xxxvi, 7, pp. 705–709, 1 fig., 1938.

Fomes pinicola [*R.A.M.*, xvii, p. 786] was reisolated in a viable condition after ten years from experimentally inoculated poplar (*Populus grandidentata*), *Tsuga canadensis*, *Picea rubra*, and birch (*Betula lutea*) in the Adirondacks, New York State. The fungus had formed no fruiting bodies and there was no external evidence of its presence in the heartwood, where the decay was relatively slow, extending vertically for a maximum distance of 95 in. (in *P. rubra*). Generally speaking, the mycelium of *F. pinicola* from coniferous hosts was equally well able to cause rotting of hardwoods and vice versa. *Pinus strobus* reacted negatively to inoculation with the fungus, while in *Abies balsamea* and beech (*Fagus grandifolia*) no clear distinction could be made between the rots due to *Fomes pinicola* and those associated with natural infection by *Polyporus balsameus* and *F. applanatus* [*Ganoderma applanatum*], respectively. The very slight amount of decay in *A. balsamea* and its absence in white pine suggests that the normally heavy resin impregnation of these woods exerts a protective influence, which may be counteracted by deep injuries or dead branches giving ingress to the fungus.

Cummins (G. B.). **A new microcyclic Coleosporium on Lumber and Piñon Pines.**—*Phytopathology*, xxviii, 7, pp. 522–523, 1 fig., 1938.

A Latin diagnosis is given of *Coleosporium crowellii* n.sp., a micro-

cyclic rust collected by I. H. Crowell on *Pinus flexilis* and *P. edulis* needles in New Mexico in 1937. The amphigenous, subepidermal, linguiform teleutosori measure 0·3 to 0·7 mm. in height, 0·5 to 2 mm. in breadth, and 0·1 to 0·15 mm. in thickness on *P. edulis*, the corresponding dimensions for those on *P. flexilis* being 0·5 to 1, 0·1 to 0·3, and 0·1 to 0·15 mm., respectively; they are orange at first, later pale to whitish-yellow, and produce concatenate, cylindrical, smooth teleutospores, orange at the base, nearly hyaline at the apex, 50 to 65 by 17 to 24 μ; the globose basidiospores measure 16 to 20 by 14 to 18 μ.

MIELKE (J. L.). **Spread of blister rust to Sugar Pine in Oregon and California.**—*J. For.*, xxxvi, 7, pp. 695–701, 1 fig., 1 map, 1938.

In 1936 white pine blister rust (*Cronartium ribicola*) [*R.A.M.*, xvi, p. 73] was detected for the first time on sugar pines (*Pinus lambertiana*) in Oregon and California and also on *Ribes* in the latter State, where all foci of infection on both hosts were situated in the extreme north-west, close to the Oregon boundary line. No new sugar pine infection centres were recorded for either State in 1937, but there was a considerable extension of the disease on *Ribes* in a southerly direction for about 125 miles in both the coastal and the Sierra Nevada mountains. In general, the development of the rust on *P. lambertiana* follows a similar course to that already studied on *P. monticola* [ibid., xvii, p. 360], previous experimental evidence as to the high degree of susceptibility of the former having been confirmed. As in earlier tests, *R. cruentum* [ibid., xvii, p. 639] and *R. nevadense* were found to be very susceptible to *C. ribicola* (the former, in fact, being probably mainly responsible for its establishment), while *R. glutinosum* is strongly resistant. The rust may be expected to continue its progress into and through California.

FISCHER (H.). **Die Douglasienschütte.** [Needle-fall of Douglas Firs.]—*Blumen- u. PflBau ver. Gartenwelt*, xlii, 28, pp. 331–332, 1 fig., 1938.

This is a semi-popular account of the needle-fall of Douglas firs (*Pseudotsuga taxifolia*) caused by *Rhabdocline pseudotsugae* [*R.A.M.*, xvii, p. 361], the increasing prevalence of which in Germany necessitated the exclusion from cultivation by the horticultural authorities in 1936 of all 'mountain' forms of the tree (vars. *glauca* and *caesia*) in favour of the resistant *viridis* [ibid., xvi, p. 507]. Under forest conditions direct control is scarcely practicable, but in the nursery good results have been obtained by applications of 1 per cent. Bordeaux mixture plus tezet [ibid., xvii, p. 682] (200 gm. per 100 l.) or alum (150 gm. per 100 l.) at ten-day intervals from the beginning of May to the end of June.

NĚMEC (A.). **Symptoms of phosphoric acid deficiency in young Pines.**—*Superphosphate*, xi, 7, pp. 121–126, 1938. [French and German translations.]

Further details are given of the pathological condition associated with phosphoric acid deficiency in young pines in various localities of Czechoslovakia [*R.A.M.*, xvi, p. 357], and of successful experiments in its control by the application to the soil, a fortnight before planting,

of superphosphate or basic slag in doses corresponding to 1·2 kg. phosphoric acid per 100 sq. m.

SCHMITZ (H.). & KAUFERT (F.). **Studies in wood decay, VII. How long can wood-destroying fungi endure immersion in water?**—*Proc. Amer. Wood Pres. Ass.*, xxxiv, pp. 83–87, 1938.

Trametes serialis, *Lentinus lepideus*, and *Lenzites trabea* growing in Norway pine [*Pinus resinosa*] sapwood [*R.A.M.*, xvii, p. 783] blocks were found to survive immersion in water for over 38 weeks at 72° F., whereas *Polyporus anceps* succumbed in 44 days under like conditions.

HIRAYAMA (S.). **Studies on the metabolism of some wood-destroying fungi.**—*Ann. phytopath. Soc. Japan*, viii, 1, pp. 9–21, 1 diag., 1938.

Details are given of the writer's studies on the metabolism (with special reference to aerobic and anaerobic respiration) of ten wood-destroying fungi, viz., *Fomes applanatus* [*Ganoderma applanatum*: *R.A.M.*, xvii, p. 713], *F. pinicola* [see above, p. 2], *F. ulmarius* [ibid., xiv, p. 532], *Polyporus betulinus* [ibid., xvii, p. 567], *P. japonicus* [ibid., xi, p. 812], *P. orientalis* [ibid., xi, p. 614], *P. schweinitzii* [ibid., xvii, p. 358], *P. sulphureus* [ibid., xvii, p.786], *Polystictus pergamenus* [ibid., xvi, p. 138], and *P. sanguineus* [ibid., xv, p. 521]. The experimental methods followed were those described by Tamiya (*Acta phytochim.*, iv, pp. 78, 227, 1928–9; vi, p. 1, 1932) and are here presented in detail.

All the organisms were found to be capable of utilizing for respiration and development the various sugars, both hexoses and pentoses (representative of the simpler carbohydrates into which the cellulose component of wood is broken up in the first stage of decay), when added to the synthetic nutrient medium. Lignin-destroying fungi can digest lignin and can presumably decompose the aromatic nucleus and aliphatic carbohydrates which constitute the two major groups of constituents of lignin. In the experiment recorded in this paper it was found that most of the phenolic derivatives are unavailable for respiration, and their general toxicity to wood-destroying fungi was confirmed, e.g., catechol, chinon, and salicylic and benzoic acids acting with particular severity on all the fungi tested. Tannic acid was found to be generally toxic to wood-destroying fungi at a concentration of M/50. On the other hand, certain compounds seemed to be toxic to some fungi and beneficial to others, parahydroxybenzoic acid, for instance, being injurious both to *Polyporus japonicus* and *P. schweinitzii* but assimilable by *Polystictus sanguineus*. Some of the wood-destroying fungi are therefore able to decompose the benzene nucleus and utilize the aromatic compounds as a carbon source for the maintenance of life. Differences in the capability of fungi to utilize the carbon source may possibly account for the specificity of the fungi in the decay of wood. The cellulose-destroying representatives of the group under observation (*F. pinicola*, *F. ulmarius*, *Polyporus betulinus*, *P. schweinitzii*, and *P. sulphureus*) showed a greater capacity for anaerobic respiration than the other five, the activities of which are mainly centred on the destruction of lignin.

CARSWELL (T. S.) & NASON (H. K.). **Properties and uses of pentachlorophenol.**—*Industr. Engng Chem.*, xxx, 6, pp. 622–626, 4 figs., 2 graphs, 1938.

Pentachlorophenol and its sodium salt (sodium pentachlorophenate) have been tested by the standard wood-block method for the control of a number of wood-destroying or -staining fungi [which are specified] and found to compare very favourably for the purpose in view with β-naphthol and *p*-chloro-*m*-cresol. A number of other fungi included in the tests were also effectively combated by the two substituted phenols.

For long-term wood preservation (the largest single use for pentachlorophenol), pressure impregnation with a 5 per cent. solution in a petroleum solvent, such as a fuel oil distillate, is advocated. The disinfected material retains its natural appearance and colour, is practically odourless, and may be painted as easily as untreated wood. Finished millwork, e.g., window sashes and frames, may be satisfactorily treated by a 3- to 5-minute dip in a solution of the same strength. Even brush-treating, which cannot ordinarily be relied upon to confer adequate protection, has given promising results in the case of southern yellow pine [chiefly *Pinus palustris*] boards infected by *Lenzites trabea.*

Pentachlorophenol is a white solid, forming acicular crystals with a crystallizing point of 190·2° C. It is only slightly soluble in water, practically insoluble in aqueous ammonia solution, but tends to form supersaturated solutions in many organic solvents. Its very low vapour pressure at ordinary temperatures is of great advantage for purposes in which lack of volatility is essential.

BUCHHOLTZ (W. F.). **Factors influencing the pathogenicity of Pythium de Baryanum on Sugar Beet seedlings.**—*Phytopathology*, xxviii, 7, pp. 448–475, 3 figs., 4 graphs, 1938.

Failure of sugar beet stands in acid (below P_H 6·5) soils at moderately high soil temperatures in northern Iowa has been found to be predominantly (over 95 per cent.) due to damping-off by *Pythium de Baryanum* [*R.A.M.*, xvii, p. 496], though *Phoma betae* [loc. cit.] and *Rhizoctonia* [*Corticium solani*: ibid., xvii, p. 498] are also pathogenic to greenhouse seedlings. *Pythium de Baryanum* causes a generalized necrosis of any part of the germinating and emerging seedling, and cortical necrosis of somewhat larger plants. In the writer's experiments it has been a much more vigorous parasite than *Phoma betae*, the slow cortical necrosis due to which is frequently overcome by affected seedlings without the development of any above-ground symptoms; neither this organism nor *C. solani* is of appreciable importance on field-grown seedlings. The diameters of the conidia, oogonia, and oospheres and oospores of the sugar beet strain of *P. de Baryanum* were 10 to 35, 16·6 to 22·1, and 13·6 to 17 μ, respectively.

In pure culture *P. de Baryanum* made scanty growth below 15° C., and at relatively low soil temperatures it is not actively pathogenic to sugar beet seedlings. Two cultures of the fungus developed uniformly well at a P_H range of 4·7 to 7·3.

In field experiments continued heavy dressings of sugar factory lime cake increased slightly the number of emerging seedlings but noticeably

raised the percentage of survival. A combination of early planting (29th April to 1st May) and seed treatment with 5 per cent. ethyl mercuric phosphate, 4 to 7 oz. per 100 lb., considerably improved the condition of affected stands, but no single practice afforded complete control of the disease.

Kreutzer (W. A.) & Durrell (L. W.). **Rot of mature tap root of Sugar Beet caused by Pythium butleri.**—*Phytopathology*, xxviii, 7, pp. 512–515, 2 figs., 1938.

A species of *Pythium* isolated in 1936 from the yellow to brown tissues of a relatively firm rot of sugar beet tap-roots in Colorado was characterized by oogonia and oospores averaging, respectively, 24 and 20·5 μ in diameter, and is referred on the authority of C. Drechsler to *P. butleri* [*R.A.M.*, xiii, p. 399]. External symptoms of the disease included extensive foliar wilting, chlorosis, and necrosis, and a dull brown, mottled discoloration of the roots, in the parenchymatous tissues and vessels of which the pathogen was present in profusion. It is not clear whether the beet-rotting fungus described by H. A. Edson as *Rheosporangium aphanidermatus* (generally known as *P. aphanidermatum* [loc. cit.]) in *J. agric. Res.*, iv, pp. 135–168, 279–292, 1915, is identical with the one under observation, but in any case the disease here reported is materially distinct, notably in the injury to the tap-roots, from the earlier trouble.

Brown (H. D.). **Cercospora control by spray and dust.**—*Proc. Amer. Soc. Sug. Beet Technol., 1938*, pp. 57–60, 1938. [Abs. in *Facts ab. Sug.*, xxxiii, 8, pp. 35–36, 1938.]

In the sugar beet-growing territory owned by the Canada and Dominion Sugar Company, where infection by *Cercospora* [*beticola*: *R.A.M.*, xvii, p. 719] has been severe in four years out of eight, crop rotation is now required by contract. Leaving beet tops on the field is regarded as a definite contributory cause of infection, and farmers are encouraged to silo the debris and use it as fodder. Since 1933 spraying and dusting experiments with Bordeaux mixture and copper-lime dusts have been conducted with highly satisfactory results, dusting being significantly the more effective and economical of the two. Three applications of dust require about 100 lb. material per acre, and the cost is equivalent to ⅔ ton of beets or 1·5 per cent. more sugar in the average crop yield.

Wade (B. L.) & Zaumeyer (W. J.). **Varietal reaction of Pea to a virus from Alsike Clover.**—*Phytopathology*, xxviii, 7, pp. 505–511, 1938.

Twenty-four of the 145 pea varieties and strains tested under field conditions in Colorado in 1935 and 1936 for their reaction to alsike (*Trifolium hybridum*) virus 1 [*R.A.M.*, xvi, p. 84] remained entirely free from infection in both years, while seven were completely susceptible. Among the resistant lines were American Wonder, Ashford, Delikatess, Nott's and Sutton's Excelsior, Horal, Little Marvel, five types of Perfection, Premium Gem, and Surprise. There was a considerably higher level of survival in 1935 than in 1936, due to the more favourable environmental conditions for the crop in the former year,

but in general the varieties ranking high in 1935 were rated fairly high in 1936.

PUGSLEY (A. T.). **Root rot of Onions.**—*J. Dep. Agric. Vict.*, xxxvi, 7, p. 320, 2 figs., 1938.

Fusarium root- or bulb-rot of onions [*R.A.M.*, xv, p. 777] every year causes progressively greater losses in Victoria. The chief factor in control consists in adequate sanitary precautions. Diseased onions should be burnt, and crop rotation practised. The practice of cleaning up diseased refuse in paddocks by turning cattle in is strongly deprecated. The crop should be promptly gathered after harvest, carefully sorted before storage, and arranged in well-ventilated stacks.

ZAUMEYER (W. J.). **A heritable abnormality of Beans resembling mosaic.**—*Phytopathology*, xxviii, 7, pp. 520–522, 1938.

Bean [*Phaseolus vulgaris*] plants (chiefly hybrids with Corbett Refugee as one of the parents) in Maryland are liable to develop a mosaic-like foliar variegation characterized by an almost complete absence of chlorophyll, resulting either in cessation of growth or stunted development, with distorted leaves and pods, sometimes accompanied by rosetting. Genetic data from crosses between Corbett Refugee and several varieties are given showing that the disorder is heritable and not due to virus infection.

SCHULTZ (H.) & RÖDER (K.). **Die Anfälligkeit verschiedener Varietäten und Sorten von Salat (Lactuca sativa L. und Lactuca scariola L.) gegen den falschen Meltau (Bremia lactucae Regel).** [The susceptibility of different varieties and types of Lettuce (*Lactuca sativa* L. and *Lactuca scariola* L.) to downy mildew (*Bremia lactucae* Regel).] —*Züchter*, x, 7, pp. 185–194, 1938.

A fully tabulated account is given of three years' (1935 to 1937) field observations at the Grossbeeren (Teltow) branch of the German Biological Institute on the reaction to downy mildew (*Bremia lactucae*) [*R.A.M.*, xvii, p. 289] of a large number of lettuce (*Lactuca sativa*) varieties of the head (var. *capitata*), cutting (var. *secalina*), picking (var. *aurescens*), summer endive (var. *longifolia*), asparagus (*L. scariola* f. *integrifolia*), and wild (Central Asian) types, supplemented by a series of greenhouse inoculation experiments in 1936–7 on 64 varieties. As regards the head type, satisfactory resistance in the field was shown by Maikönig and Böttner's forcing varieties, with mean infection values of 1·1 and 1·5, respectively (1 representing absence of infection and 5 a high incidence), closely followed by Buse's Brown (1·7); by the early varieties Maikönig (2·1), Augsburg, Bismarck, Naumburg, and Suabian (2·3), Allerfrühster gelber (2·3), Express (1·9), Hamburg Market (2·1), Grosser früher gelber (2·3), and Herzenas, Hochheim Dauerkopf, and Riesengelber (2·3); and by the summer varieties Riesenkristallkopf (2·1), Essling Brown Market, Goldforellen, Graf Zeppelin, Heilbronn, and Wunder der Jahreszeiten (2·3), Bonn Silberkopf and Fürchtenichts (2·4), Graz Krautkopf, Laibach Eis, Wunder von Marbach, and Venlo Butterkopf (1·9), Imperial Yates, Hungarian Hitzkopf, and Wunder von Vorberg (1·7), the three last-named varieties, however, together

with Yaramoundi (no infection) having been tested in 1937 only. The cutting types are generally only slightly infected; among the most resistant varieties in the field were Delikatess and Mooskrauser (2·3), the same value being obtained for two representatives of the picking type, American Brown and Australian Yellow. A high degree of susceptibility was manifested by the summer endive varieties (3·4 to 4·4 average of all for the three years), and similar observations were made in respect of the asparagus type. Except in 1936 the five Central Asian strains proved fairly resistant.

The important bearing of temperature and atmospheric humidity on the development of the disease is discussed [loc. cit.]. In connexion with the latter factor it is stated that no new lesions were formed on plants in the open during the second half of June, 1936, when hot (mean temperature 20° C.), practically rainless conditions prevailed, whereas numerous fresh sporangia were produced immediately following thunder rain on 1st July, indicating that the fungus had gained a foothold at an earlier stage but was unable to fructify until the atmosphere was sufficiently damp (96 per cent. relative humidity).

In the greenhouse inoculations the reactions of older plants were similar to those displayed in the field, though the symptoms of infection tended to be more intense. Young plants were uniformly susceptible, whatever their behaviour in the field. The wild varieties, *L. virosa* and *L. scariola*, reacted to downy mildew infection similarly to the cultivated types. In the course of these tests two physiologic races of *B. lactucae* were differentiated, one (D) being non-pathogenic to Hindenburg, Maiwunder, Frühlingswunder, Viktoria Forcing, and Wehrden, whereas the other, (G), attacked all varieties with uniform severity but spared a few individuals, more especially within such ordinarily susceptible varieties as Bautzen Dauerkopf, encouraging the hope of eventually securing resistant strains by a process of mass selection.

CAYLEY (D[OROTHY] M.). **The history of the cultivated Mushroom.**—*Gdnrs' Chron.*, civ, 2690, pp. 42–43, 3 figs. (1 on p. 39), 1938.

The author briefly surveys the history of the cultivated mushroom in France, Britain, and the United States, the earliest French record dating from 1678. Contrary to the commonly accepted view, she considers that the cultivated mushroom does not owe its origin to *Psalliota campestris* but is probably derived from a manure-inhabiting species.

CAYLEY (DOROTHY M.). **Mushrooms.**—*J. R. hort. Soc.*, lxiii, 7, pp. 325–333, 1938.

Most of the results of the author's study on the growth of the cultivated and the wild species of mushroom on artificial composts have already been noticed from other sources [*R.A.M.*, xvii, p. 648]. In the present paper the author states that on unfermented sterilized composts of moistened chopped straw, chopped hay, and sand with or without oats, both wild grassland [including *Psalliota campestris* and *P. arvensis*] and wild haystack mushrooms [*P.* sp.] and cultivated forms [*P.* spp.] grew vigorously, and the mixture with crushed oats and nutrient solution added has been adopted as a standard spawn-growing

compost. All attempts have so far failed, however, to grow the wild grassland species on either fermented or naturally rotted composts under ordinary cultural conditions, while the wild haystack mushroom, a species excellent in flavour and consistency, was found to grow rapidly and to fructify on a cheap mixture of naturally rotted material with one-half to one-third the volume of soil. It may be possible to bring this form into cultivation, but it will not tolerate fermentation accompanied by the generation of heat, and requires artificial heating. The labour and the costs entailed in cultivating this species will, it is thought, compare very favourably with the present-day practice of growing mushrooms on composted stable manure.

Sinden (J. W.). **Synthetic compost for Mushroom growing.**—*Bull. Pa agric. Exp. Sta.* 365, 27 pp., 2 figs., 1938.

In experiments recorded in this paper six variations of synthetic composts for mushroom [*Psalliota* spp.] growing [see preceding abstracts] were compared in five replications at the experimental mushroom house at the Pennsylvania Agricultural Experiment Station. The compost piles usually consisted of 500 lb. dry straw, to which other ingredients were added, and the yields of mushrooms were computed on the basis of pounds of mushrooms per ton of manure or synthetic material used. In tests with horse manure it was found that droppings are not essential for the growth of mushrooms, since the yields from composts containing either droppings or bedding straw, or with various combinations of the two, did not differ significantly. In tests with synthetic composts, that made up in the proportion of 482 lb. wheat grain and 22 lb. urea per ton of straw produced 444 lb. mushrooms per ton of straw used, approximately two-thirds as much as a control compost of horse manure. The presence of wheat caused a more rapid decomposition. A computation of yields from piles with different amounts of wheat showed that the addition of much wheat grain is unprofitable, whereas the use of some grain is beneficial. The addition of increasing amounts of urea increased the rate of decomposition of the synthetic composts, 32 lb. urea per ton of straw being, however, the maximum quantity which may be added advantageously at one time. When larger amounts of urea were added the rate of decomposition decreased. The piles composted 21 and 25 days produced more mushrooms than those composted longer, the increasing loss of total organic matter during the composting process being the principal cause of the gradual decrease in yield. A provisional formula for synthetic compost for the use of the mushroom grower is outlined as follows. In order to ensure rapid decomposition the straw should be watered during spreading and trampled down as it is distributed; the finished piles should be 4 to 5 ft. high and solidly packed throughout. After four days the pile should be turned for the first time and urea added (at the rate of 28 lb. per ton of dry straw) by sprinkling it (as a solution of 1 lb. per gal.) during turning and trampling. Water may be added during the process but not in excess. At the second turning four days later wheat soaked over-night in water should be added evenly at the rate of not more than 400 lb. per ton of dry straw. Sufficient water may be added to keep the pile wet. After turning, the pile should be compacted by

walking over the top. For the third time the pile should be turned like manure after adding water and not trampled down. Four days to a week later the beds should be filled 7 in. deep and packed quite firmly. The house should be kept hot long enough to kill the insects and the spawn planted when the temperature drops to 75° or 80° F. The finished compost is similar in texture and odour to composted horse manure but is of greater bulk per unit weight.

CASTEL (P.) & BOSC (M.). **Sur la localisation du cuivre dans les tissus foliaires de la Vigne après traitement au sulfate de cuivre.** [On the localization of copper in the foliar tissues of the Vine after treatment with copper sulphate.]—*C.R. Acad. Sci., Paris*, cvii, 2, pp. 179–181, 1938.

With the aid of various reagents the authors examined samples of vine leaves collected at intervals of a few days to two months after spraying with copper sulphate against downy mildew [*Plasmopara viticola*], and ascertained that the fungicide was localized on the cuticle and had not penetrated the underlying tissues.

SAREJANNI (J. A.). **Notes phytopathologiques II.** [Phytopathological notes II.]—*Ann. Inst. phytopath. Benaki, Greece*, ii, 2, pp. 86–92, 1936. [Received November, 1938.]

A Latin diagnosis is given of *Septoriella oleae* n.sp., frequently found in association with *Macrophoma dalmatica* on prematurely fallen olive fruits [*R.A.M.*, xvi, p. 546] in various parts of continental Greece. The infected olives may be either green or black, shrivelled, and wrinkled, the entire surface covered with minute fissures, similar to those produced by *Gloeosporium olivarum*, along which are borne masses of black pycnidia, 0·5 to 1 mm. in diameter, up to 6-loculate, and lined with filiform, hyaline, straight or sinuous conidiophores, 24 to 44 by 2 μ, bearing at their apices subfusoid or oblong, straight or slightly falcate, hyaline, guttulate, uni- to biseptate conidia, 15 to 30 by 4 to 6 μ. Like *M. dalmatica*, *S. oleae* is a secondary parasite, entering the fruits through injuries inflicted by the olive fly, *Dacus oleae*. The disease reaches a climax in August, so that the new pathogen is evidently capable of survival at fairly high temperatures.

Loquats in the Lamia district were very severely attacked, during a damp and rather cold spell in April, 1937, by *Sclerotinia laxa*, apparently not recorded hitherto on this host. The loquat is also believed to be a new host for *Botrytis cinerea*, which was prevalent on the fruit at the same time in the gardens of Kiphissia. *S. sclerotiorum* occurred in a destructive form on Vines at the end of March, 1936, in a group of islands near Chio, attacking the young shoots as they reached a length of 40 to 50 cm. [ibid., xiii, p. 746]; the fungus is widespread on figs in the Peloponnesus.

In 1933 five- to six-year-old Devino vines growing on a heavy clay soil inundated by floods in a narrow valley near Janina, Epirus, developed pronounced symptoms of court-noué restricted to the tendrils of one or two branches, which shrivelled in August without causing any further damage to the stocks. The disease occurred in

isolated patches in the vineyards and apparently spread through the soil. *Pythium de Baryanum* was isolated from the diseased tissues.

A Latin diagnosis is given of *Microdiplodia capsici* n.sp., the agent of sharply defined, whitish-grey spots, 2 to 3 mm. in diameter, with a yellowish-brown border, on living chilli leaves at Kiphissia. The sparse, ostiolate, black pycnidia of the fungus measure 100 to 125 μ in diameter, and the abundant subellipsoid, straight or slightly curved, uniseptate, olivaceous conidia 8 to 11 by 2 to 3 μ; conidiophores were not observed. The lesions due to *M. capsici* resemble those produced on the same host by *Vermicularia* [*Colletotrichum*] *capsici* [ibid., xv, p. 344].

BALLARD (E.). **Report of the Chief Plant Protection Officer for the year ended 31st March, 1938.**—*Rep. Dep. Agric. Palestine, 1937–8*, pp. 71–73, 1938.

In this report *Puccinia antirrhini* is recorded as developing in a destructive form [on *Antirrhinum majus*] in private gardens in Jerusalem and Tel Aviv [cf. *R.A.M.*, xvii, p. 602].

JOHNSTON (C. O.), LEFEBVRE (C. L.), & HANSING (E. D.). **Kansas mycological notes, 1936.**—*Trans. Kans. Acad. Sci.*, xl, pp. 69–74, 1938.

One of the most interesting developments in Kansas during 1936 [cf. *R.A.M.*, xvii, p. 16], from the standpoint of applied mycology was the exceptionally heavy incidence of smuts on oats (*Ustilago avenae* and *U. levis* [*U. kolleri*]), 25 per cent. of panicle infection being frequently observed, while counts of 86 and 98 per cent. were also reported. *U. avenae* has long predominated under local conditions, but during 1936 there was an unusual abundance of *U. kolleri*. Bacterial blight of smooth brome grass (*Bromus inermis*), caused by *Bacterium coronafaciens atropurpureum*, was prevalent after rainy weather towards the end of April and was followed by severe infection by *Septoria bromi*, the pycnidia of which almost covered many of the leaves. Evidence was obtained of individual resistance to *Puccinia andropogonis* among the very nutritious fodder grasses, *Andropogon furcatus* and *A. scoparius*, and a similar reaction to *Sorosporium everhartii* was observed in the case of *A. furcatus*, apparently a new host. Other noteworthy records on grasses include *S. provinciale* on *A. furcatus* and *Sphacelotheca andropogonis* on *A. scoparius*. Lucerne was infected by *Ascochyta imperfecta* [ibid., xvi, p. 258]. Chinese elm (*Ulmus pumila*) leaves were attacked by *Gnomonia ulmea* [ibid., xiv, p. 203]. Severe damage to privet was caused by *Glomerella cingulata* [ibid., ix, p. 654].

BOURIQUET (G.). **Madagascar: A list of parasites and diseases of cultivated plants.**—*Int. Bull. Pl. Prot.*, xii, 9, pp. 191–192, 1938.

The following are among the records comprised in this continuation (extending to March, 1938) of the writer's list of Madagascan plant parasites and diseases [*R.A.M.*, xvi, p. 590]: *Sphaerotheca pannosa* on peach, *Leveillula* [*Oidiopsis*] *taurica* on eggplant [ibid., v, p. 20; xvii, p. 217], and *Spongospora subterranea* on potato.

Franco (R. M.). **Enfermedades de la Papa, Algodón, Arroz, Cabuya, Caña, y Cacao.** [Diseases of Potato, Cotton, Rice, Agave, Sugar-Cane, and Cacao.]—*Agricultura, Bogotá*, x, 12, pp. 344–356, 1938.

Popular notes are given on the following diseases and their control in Colombia: *Corticium vagum* [*C. solani*], *Sclerotinia sclerotiorum*, *Spongospora subterranea*, *Alternaria solani*, and *Puccinia pittieriana* [*R.A.M.*, xiv, p. 325] on potatoes; *Bacterium malvacearum*, gummosis (*Bacillus gossypinus* and *Gibberella saubinetii*), and *Cerotelium desmium* [ibid., xvii, p. 98] on cotton; *Helminthosporium oryzae* [*Ophiobolus miyabeanus*] and *Piricularia oryzae* on rice [ibid., xvi, p. 202]; *Colletotrichum agaves* [ibid., xvii, p. 322], *Coniothyrium* (?) *concentricum* [ibid., xii, p. 550], and *Corticium salmonicolor* on *Fourcroya* [*Furcraea*]; mosaic [ibid., xvi, p. 711] and *Sclerotium rolfsii* on sugar-cane; and *Diplodia cacaoicola* [*Botryodiplodia theobromae*: ibid., ix, p. 437] and *Colletotrichum* on cacao.

Winkelmann (A.). **Die Entwicklung der Lohnbeizkontrolle in Westfalen und ihre Bedeutung für die landwirtschaftliche Praxis.** [The development of supervision of commercial seed-grain disinfection in Westphalia and its importance in agricultural practice.]—*Kranke Pflanze*, xv, 9, pp. 145–149, 1938.

The commercial seed-grain disinfection depots in Westphalia [cf. *R.A.M.*, xvii, p. 509] were put under State supervision in 1930–1, when of the existing 189 only 111 were found to be adequately equipped and were officially approved. Within a year the percentage of insufficiently treated seed samples fell from 80 to 40 and thereafter was gradually reduced to 16·6 in 1936. In 1937 there existed 485 officially approved depots, about 40 per cent. being in the hands of millers. The short disinfection process is steadily gaining ground, the number of depots provided with appropriate equipment having risen from 8 in 1934 to 130 in 1937.

Selariès [P.] & Rohmer [G.]. **Essais sur la carie du Blé en Alsace.** [Experiments on Wheat bunt in Alsace.]—*Ann. Épiphyt.*, N.S., iii, 2, pp. 175–185, 1937. [Received October, 1938.]

In tests of the chief wheat varieties grown in Alsace for susceptibility to bunt (*T. tritici* [*T. caries*] only) a strain of *T. caries* from Dijon was used in 1929 to infect Alsace 22, Bordeaux 115, and Squarehead 240 and the bunt transferred to the same varieties a year later. The results obtained from the 1930 inoculations showed that the three varieties had, respectively, 28·9, 11·6, and 11·4 per cent. bunted plants and 18·2, 7, and 6·7 per cent. bunted ears, the corresponding figures for Vilmorin 27 (used for comparative purposes) being 43 and 33·2 per cent. In the same experiment heavily infected seed of these varieties was dusted with cupric chloride+talc, copper oxychloride, and copper carbonate, each used at the rate of 250 gm. per 100 kg. of seed, or was immersed for one hour in a 0·5 per cent. solution of copper sulphate (followed by dusting with slaked lime) or for 15 minutes in a 0·25 per cent. solution of commercial formalin. The formalin treatment gave complete control, while the dust treatments showed infection ranging from 2·6 to 6·6, 0·7 to 3·9, and 1·6 to 4·8 per cent. bunted ears, respec-

tively, and from 4·2 to 14·7, 0·9 to 8·1, and 2·6 to 8 per cent. bunted plants, respectively. The copper sulphate and lime gave 0·1 to 3·2 per cent. bunted ears, and 0·8 to 5·5 per cent. bunted plants.

Certain races of *T. caries* from other localities were more virulent to the local wheat varieties than were the local races of the fungus, but the passage of a given race to a variety known to be resistant did not appear to increase its virulence towards the local wheats.

CRÉPIN (C.), BUSTARRET (J.), & CHEVALIER (R.). **Le problème de la création des Blés résistants à la carie.** [The problem of the development of Wheats resistant to bunt.]—*Ann. Épiphyt.*, N.S., iii, 3, pp. 323–439, 1937. [Received October, 1938.]

In this paper the authors review in detail the information so far available on the development of resistance to wheat bunt (*Tilletia caries* and *T. foetens*) and give a full account of preliminary work carried out by them on this problem at Dijon from 1927 to 1936. It appears that the only species of *Tilletia* present in France is *T. caries*, although in northern Africa the more prevalent bunt organism is *T. foetens*. In areas where both fungi are present hybrid types are found.

In the climatic conditions prevailing in France, sowings made in the rather late autumn or rather early spring are the most likely to show a high rate of infection. Optimum conditions for infection are set up when the soil temperature lies between 5° and 12° C. at sowing time and during the three or four following weeks. Average soil humidity, a well-aerated soil, and somewhat deep sowing also favour infection. Some varieties resistant to infection when sown in spring become susceptible when sown in autumn. In some cases a form of latent infection is set up, in which modifications occur in the vegetative parts, but no spores are formed in the ears.

At least two types of resistance appear to exist. In some cases the fungus is able to penetrate only the external tissues of the host, where it soon dies. In others it reaches the growing point and develops more or less readily in the tissues but either it does not fructify (latent infection) or it does so with difficulty (partial infection). The environmental conditions of the host are of no importance for varieties possessing, for any given form of bunt, the former type of resistance, but they may markedly affect the apparent resistance of varieties showing the latter type. Resistance in either case is a varietal character, falling into the category of 'physiological immunity' and is related to hereditary factors.

Observations at Dijon demonstrated that the hereditary transmission of bunt resistance does not take place in the same way in all resistant varieties. Resistance to bunt is a character entirely independent of other morphological or physiological characters. Resistance to any given race of bunt is rarely simple, two or more factors being involved in most cases. Two wheats resistant to the same race of bunt need not necessarily possess the same factors for resistance, and, furthermore, in a given wheat resistance to several races of bunt may be governed by different factors. This multiplicity of factors accounts for the large number of 'types of resistance' observed. Starting with highly susceptible French wheats and resistant foreign wheats the authors have

developed by hybridization new wheats of the French type which are as resistant to bunt as their resistant parent.

The physiologic races of *T. caries* occurring in France do not appear to show high virulence, and do not, for the most part, infect the Hussar variety.

STARR (G. H.). **Field experiments on bunt of Wheat.**—*Bull. Wyo. agric. Exp. Sta.* 226, 23 pp., 7 figs., 1938. [Abs. in *Exp. Sta. Rec.*, lxxix, 4, p. 353, 1938.]

In field experiments on wheat bunt in Wyoming from 1932 to 1936, *Tilletia levis* [*T. foetens*] was found to be much more prevalent than *T. tritici* [*T. caries*] as an agent of the disease. Seed-borne infection was best controlled by ceresan and formaldehyde, the latter, however, being liable to injure the seed-grain. Copper carbonate and coppercarb were about equally effective, neither reaching the standard of the two foregoing. The average incidence of bunt in early plantings was 78·3 per cent., with a progressive decline in subsequent sowings down to 11·5 per cent. in late ones. Temperature relations thus appear to be of great importance in the development of *T. foetens*. In general, more bunt occurred in irrigated (37·6 per cent.) than in non-irrigated plots (26·9). Soil infestation did not appear to play an important part in the causation of the disease, except possibly in 1935.

HELY (F. W.), ALLAN (F. E.), & ANGELL (H. R.). **Bunt infection and root development in Wheat.**—*J. Coun. sci. industr. Res. Aust.*, xi, 3, pp. 254–255, 1938.

In pot experiments on Nabawa wheat, susceptible to bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*] the root growth of eight-week-old plants grown from grain inoculated with *T. caries* and *T. foetens* was considerably reduced, the mean weight of dry roots per pot being 1·05 gm. for the inoculated plants and 1·30 gm. for the uninoculated control. The slight depression in the weight of the tops was not significant.

ANGELL (H. R.), ALLAN (F. E.), & HELY (F. W.). **The effect of Urocystis tritici Koern. on the extent of development of the roots and aerial parts of the Wheat plant. II.**—*J. Coun. sci. industr. Res. Aust.*, xi, 3, pp. 256–257, 1938.

Further experiments on the effect of *Urocystis tritici* on the development of tops and roots of wheat plants of the varieties Nabawa (highly resistant), Ford (moderately resistant), and Federation (very susceptible) brought further confirmation of the results previously obtained [*R.A.M.*, xvi, p. 664]. The inoculations resulted, in all experiments except one (made in late summer and probably affected by high temperature after germination), in a significant reduction of root and top growth of all varieties, the top development being, however, in one experiment less marked in Nabawa than in the others.

ALLEN (P. J.) & GODDARD (D. R.). **Changes in Wheat metabolism caused by powdery mildew.**—*Science*, N.S., lxxxviii, 2278, pp. 192–193, 1938.

With the aid of a Fenn micro-respirometer (*Amer. J. Physiol.*,

lxxxiv, p. 110, 1928), the writers were able to measure separately the respiration and fermentation of wheat infected by powdery mildew (*Erysiphe graminis tritici*) [*R.A.M.*, xvii, p. 806]. Normal plants were heavily inoculated ten days after planting, and the first leaf used for experimental work 7 to 8 days later. By carefully scraping away all the leaf tissue except the lower epidermis, the latter may be obtained as a strip a single cell thick, with the large-lobed haustoria of the pathogen uninjured. Determinations on 5 sq. cm. of normal epidermis gave no respiration within the limits of the apparatus ($\pm$ 0·05 cu. mm. oxygen per sq. cm. surface per hour), whereas with a similar area of mildewed epidermis the oxygen consumption amounted to 1·3 cu. mm. per sq. cm. surface per hour. On removal of the mildew from the epidermis with a camel-hair brush the oxygen consumption disappeared and consequently oxygen consumption is a measure of mildew respiration. On the other hand, the respiration of infected wheat was increased 250 per cent. above the normal and the removal of the mildew from the plant with a camel-hair brush failed to induce a reversion to the normal level of respiration. A 0·001 molar solution of sodium azide nearly inhibited the respiration of the fungus while leaving that of normal wheat virtually unimpaired, and treatment of mildewed wheat with this substance caused a decrease in respiration corresponding to that of the mildew, indicating that the host is predominantly concerned in the increased respiration associated with infection. An increase of some 50 per cent. in host fermentation [as measured by anaerobic carbon dioxide production] was caused by the disease. These changes in the host metabolism occur in the green mesophyll cells which are not in actual contact with the fungus. The destruction of functional chlorophyll appears, from preliminary measurements of the effect of mildew on photosynthesis, to take place subsequently to the modifications in fermentation and respiration under observation.

Runge. **Beobachtungen zur Halmbruchkrankheit des Weizens 1938 (Cercosporella herpotrichoides).** [Observations on the straw-breaking disease of Wheat in 1938 (*Cercosporella herpotrichoides*).]—*Dtsch. landw. Pr.*, lxv, 33, p. 421, 2 figs., 1938.

Observations in the Schmatzin district of Germany in 1938 showed that not only the crop immediately preceding wheat exerts an influence on the extent of the damage caused by *Cercosporella herpotrichoides* [*R.A.M.*, xv, p. 783] but also the one before that. A particularly deleterious rotation was winter barley-potatoes-wheat, the last-named being lodged to the extent of 90 per cent. Winter barley preceding rape was somewhat less injurious, but the following wheat crop sustained 50 per cent. injury. Summer wheat preceding potatoes also exercised an adverse effect on the following wheat crop, whereas summer barley was more advantageous in this respect.

Utter (L. G.). **Culture and inoculation studies on races of the loose and covered smuts of Oats.**—*Amer. J. Bot.*, xxv, 3, pp. 198–210, 1 pl., 1938.

Cultural studies are described with eleven physiological races of the loose smut and seven of the covered smut of oats (*Ustilago avenae* and

U. levis [*U. kolleri*: *R.A.M.*, xvii, p. 738]), obtained by Reed and established as distinct physiologic races by their constant pathogenicity. The size, colour, and topography of the growths of single sporidia, single chlamydospore, and dilution cultures were determined for 274 triplicate culture sets of the former smut and 307 of the latter. Approximately 60 per cent. of all the sets of both smuts showed dissimilarities and successive culture generations failed to remain constant in character, regardless of the isolation method used. The single sporidial cultures of either smut could be roughly grouped, on the basis of colour and certain topographical characteristics, into four classes, whereas the dilution and the single chlamydospore cultures varied so much in size and colour that they could not be grouped. Similarities or dissimilarities between the different races of either smut and between the races of both smuts could be shown by a careful selection of individual cultures. These dissimilarities were not permanent and were sometimes more pronounced between different isolations of the same race than between two different races. Cultural characteristics were thus found unreliable as means of identification of the smut races.

In inoculation experiments single sporidial cultures of the two smuts (race 1 of each) failed to produce infection on their respective susceptible host varieties, while single sporidial cultures of the loose smut paired in various combinations produced typical smut symptoms; three combinations of the covered smut gave negative results indicating the 'sexual' similarity of the cultures involved. Two combinations of cultures of loose smut paired with cultures of covered smut produced on the variety Monarch (normally susceptible only to covered smut) a new type of smut having the symptoms and morphological characteristics of the loose smut but the pathogenic qualities of the covered smut; no infection was produced on the variety Gothland (normally susceptible to loose smut). Successive inoculations of differential host varieties with such hybrid chlamydospores from each generation revealed at least sixteen new and distinct smut types exhibiting recombinations of factors for symptoms, morphology, and pathogenicity. Some of these types, which are considered to be new physiologic races, remained constant for their respective characteristics during two or three generations.

VAUGHAN (E. K.). **A race of Ustilago avenae capable of infecting Black Mesdag Oats.**—*Phytopathology*, xxviii, 9, pp. 660–661, 1938.

In 1936 two collections of *Ustilago avenae*, one from Kansas and the other from Oklahoma, produced, respectively, 23 and 30 per cent. smutted heads on the normally resistant Black Mesdag variety [*R.A.M.*, xiii, p. 761; xvii, p. 658]. Each collection was increased on Black Mesdag and Anthony (susceptible) in 1936 and in the following year seven varieties of oats were inoculated with these collections and with two others increased on Anthony and Gopher. Chlamydospores of the two collections produced on Black Mesdag in 1936 were much more severely pathogenic to this variety (84 and 48 per cent. infection from the Oklahoma and Kansas strains, respectively) than those of the same material produced on Anthony (15 and 26, respectively). The Oklahoma (but not the Kansas) collection from Black

Mesdag also caused much heavier infection (76 per cent.) in Double Cross II 20–220 (Minota×White Russian)×Black Mesdag, hitherto resistant, than that from Anthony (3 per cent.). Bond, Markton, and South Dakota No. 165 remained resistant to the new collections irrespective of the variety on which the latter were increased. These data are regarded as confirmatory of previous observations by various workers as to the increase of pathogenicity acquired by a given smut collection towards a normally resistant variety by successive inoculations of the latter owing to the augmented proportion of biotypes capable of developing thereon [ibid., xiii, p. 364 *et passim*].

Rivier (A.). **Contribution à l'étude du traitement du charbon nu de l'Avoine.** [Contribution to the study of the control of loose smut of Oats.]—*Ann. Éc. Agric. Montpellier*, N.S., xxv, 2, pp. 183–192, 1938.

The results of two further years' tests of oat seed-grain treatments for the control of loose smut [*Ustilago avenae*] in France [*R.A.M.*, xv, p. 791] showed that, under the conditions of the experiments, the degree of contamination of the seed-grain (Noire d'hiver de Belgique variety) with smut spores was of greater importance in determining the percentage of smut in the resulting crop than the degree of soil contamination. Among the dust disinfectants tested, almost complete control (0·92, 0, and 0 per cent. infection in three tests) was afforded only by a mixture of 8 parts trioxymethylene and 92 parts talc, the untreated seed yielding 50, 34·61, and 49·4 per cent. smut; the mixture slightly retarded the emergence of oat seedlings and very slightly decreased the percentage germination in the field, but its high fungicidal efficiency warrants the tests being repeated on a larger scale. In the same experiment steeping the oat seed for two hours in a 1 in 2,000 solution of cryptonol [ibid., xvii, p. 182] was almost as effective as steeping for the same time in a 1 in 1,000 silver nitrate solution, the two treatments, in three tests, reducing the percentage of resulting smut to 3·45, 1·98, and 5·94, and to 4·9, 1·08, and 3·63 respectively. The addition of 1 gm. terpenic alcohol [ibid., xvii, p. 500] per l. disinfectant solution markedly increased the fungicidal efficiency of the latter in every case.

Hoppe (P. E.). **Relative prevalence and geographical distribution of various ear rot fungi in the 1937 Corn crop.**—*Plant Dis. Reptr*, xxii, 12, pp. 234–241, 2 graphs, 1938. [Mimeographed.]

A survey of the maize ear rot fungi present in samples of grain of the 1937 crop taken from carloads at terminal markets in the United States [*R.A.M.*, xvi, p. 310] showed the crop to be one of the cleanest on record as regards ear and kernel rot diseases. Throughout the maize belt itself the incidence of *Diplodia zeae* was lower than in any of the previous five surveys, but in the Atlantic seaboard states it was again the principal fungus and was particularly prevalent in Alabama and Mississippi. In samples from southern States the ratio of *D. macrospora* to *D. zeae* was approximately 1 to 30, which agrees well with Larsh's recent observations [ibid., xvii, p. 670]. *Fusarium moniliforme* [*Gibberella fujikuroi*] was the most prevalent fungus in the samples from all States west of the Mississippi, as well as in Illinois, Indiana,

Maryland, Kentucky, and Tennessee. As in previous surveys, *G. saubinetii* was generally confined to the more humid sections of the maize belt east of the Mississippi. Owing to very favourable weather conditions during maturation the incidence of *Nigrospora sphaerica* was low. *N. oryzae* was isolated from a damaged kernel from Iowa.

The ratio of *Aspergillus* to *Penicillium* spp. increased from the humid regions east of the Mississippi to the drier areas to the west of the river [ibid., xvii, p. 519].

ITZEROTT (DOROTHEA). **Die Wirkung wuchsstoffhaltiger Substanzen junger Maispflanzen auf das Wachstum von Ustilago zeae.** [The influence of auxin-containing substances of young Maize plants on the growth of *Ustilago zeae*.]—*Arch. Mikrobiol.*, ix, 3, pp. 368–374, 1938.

In experiments at the Phytopathological Institute, Landsberg-an-der-Warthe, Germany, the growth of maize smut (*Ustilago zeae*) on a synthetic dextrose-containing medium was markedly stimulated by the addition of an extract of the coleoptiles of young plants at the rate of 1 c.c. per 20 c.c. A similar but weaker effect was produced by an extract of young maize leaves, and also by low concentrations of hetero-auxin (β-indoleacetic acid) and vitamin C (l-ascorbic acid), the former acting most vigorously at 0·0001 and the latter at 0·1 per cent.

HUNT (W. H.) & THOMPSON (M. R.). **A pharmacological study of Ustilago.**—*J. Amer. pharm. Ass.*, xxvii, 9, pp. 740–752, 6 graphs, 1938.

A tabulated account is given of the authors' studies, by a variety of pharmacological procedures, on the action of extracts of maize smut (*Ustilago maydis*) [*U. zeae*] on laboratory animals. The drug induced toxic effects of a varying nature [cf. *R.A.M.*, xvii, p. 174] on the different animals used in the tests, except in feeding experiments on white rats. The nature of the active substance of the smut has not been definitely determined: it is in any case not related to acetylcholine or histamine, while alkaloids are also apparently absent.

VAHEEDUDDIN (S.). **The production of a new physiologic race of Sphacelotheca sorghi.**—*Phytopathology*, xxviii, 9, pp. 656–659, 1 diag., 1938.

A new physiologic race of *Sphacelotheca sorghi* [*R.A.M.*, xvii, p. 453] has been developed in the following way. In 1929 L. J. Tyler obtained a collection of the smut from Texas and isolated individual sporidia from the promycelia of several chlamydospores. The resultant monosporidial lines were inoculated into sorghum in various sexually compatible combinations with positive results. The writer carried out further experiments with the Texas material, crossing two monosporidial lines derived from separate chlamydospores. This process was effected by growing the lines separately in potato dextrose broth and injecting a mixture of the two cultures into Minnesota Amber sorghum plants. The resultant chlamydospores were designated cross 122, and by crossing this with a monosporidial line from a third chlamydospore, cross 123 was obtained, which on selfing yielded

cross 124. This differed in pathogenicity from any race hitherto described, as shown by experiments at St. Paul, Minnesota, in 1935, supplemented by others in 1936 in which the five races of *S. sorghi* previously recognized [ibid., xi, p. 448] were included.

The experimental data showed that the new cross (designated race 6) differs from races 5 and 4 in its lack of pathogenicity to Kafir×feterita (H.C. 2423) and White Yolo (K.B. 2525), respectively, from 3 in its failure to attack Pierce Kaferita (K.B. 2547), feterita (S.P.I. 51989) and Kafir×feterita, from 2 in sparing the Dwarf Yellow milos and White Yolo, and from 1 in causing slight infection of Hegari. It may further be distinguished from races 1, 2, and 3 in its action on the Schrock and Reed Kafir varieties, on which it produced 62 and 85·5 per cent. smut, respectively, as compared with 23·1, 16·5, and 23 per cent., respectively, for the other three races on the former and 0, 9·2, and 43·5 per cent., respectively, on the latter. Another feature of cross 124 is its grey to brownish peridium, in which it resembles races 2, 3, and 5 but differs from 1 and 4, with their brown peridia.

EBELING (W.), KLOTZ (L. J.), & PARKER (E. R.). **Experiments on Navel water spot.**—*Calif. Citrogr.*, xxiii, 10, pp. 410, 434–436, 3 figs., 1938.

Experiments conducted in 1937–8 in two groves at Claremont with the aim of determining the effect of oil sprays on the incidence of water spot of Navel oranges [*R.A.M.*, xvii, p. 811] showed that plots sprayed with the usual light medium oil had 17·3 and 32·1 per cent. water spot for the two groves, respectively, while the plots sprayed with a light toxic oil had 11·3 and 21·8 per cent. water spot, respectively, and those treated with miscible oil (used with lime-sulphur or ammonium polysulphide), with non-oil sprays, or fumigated, had 5 and 10·8 per cent. water spot, respectively, or less. The percentage of fruit affected with water spot initiated by wounds was larger in the oil-sprayed plots. The percentage of fruit free from water spot in the first grove was 73·6 to 76·4 in the plots sprayed with oil, 82·5 in plots sprayed with oil and wax emulsion, 81·2 in plots sprayed with light toxic oil, and 85·7 to 89·9 in the fumigated, non-oil-sprayed, and untreated plots, while the corresponding figures for the second grove, which had suffered more severe damage from water spot, were 53·4 to 59·3 for oil-sprayed plots, 63·4 for plots sprayed with oil and wax emulsion, 72·4 for plots sprayed with light toxic oil, and 81·5 to 86·7 for the fumigated, non-oil-sprayed and untreated plots. These results substantiate field observations on the role of oil sprays as a factor favouring the development of water spot.

MANDELSON (L. F.) & BLACKFORD (F. W.). **Brown spot of the Emperor of Canton Mandarin and its control.**—*Qd agric. J.*, 1, 2, pp. 132–143, 2 figs., 1938.

Brown spot of Emperor mandarins [*R.A.M.*, xvii, p. 376], a serious disease in Australia, appears to be restricted to New South Wales, where it has been known for many years, and Queensland, where it was first observed in 1928.

The first symptom is a black dot on the surface of the fruit shortly

after setting. This becomes a sunken, chocolate-coloured, circular spot $\frac{1}{8}$ to $\frac{3}{8}$ in. in diameter, with a raised area in the centre. Infection may occur at any point, frequently at the insertion of the stalk. Affected fruits tend to fall, especially when half-grown. Two forms of infection occur on the twigs. In one, the terminal shoots are brown and curled over, as if scorched by fire, the transition from diseased to healthy tissue being very abrupt. In the other, dark, sunken spots similar to those on the fruits, develop, and may emit large masses of gum; they tend to enlarge and form cankers. Dark brown spots, often surrounded by a light green to creamy halo, occur on the leaves, often at the margin, causing puckering and distortion. Affected leaves also tend to drop. Diseased trees produce new growth almost continuously throughout the season; this rapidly becomes affected, resulting in the presence of a large amount of dead wood.

Isolations by the junior author from fruit and leaf spots frequently yielded a species of *Gloeosporium*, inoculations with some strains of which on the uninjured rind of picked fruits gave typical lesions. Occasionally, young leaves on budded nursery trees sprayed with a spore suspension of the fungus developed typical spots accompanied by distortion.

Spraying tests [the results of which are tabulated] carried out from 1931 to 1938, inclusive, showed that effective control was given by three applications of home-made colloidal copper [loc. cit.].

Brown (J. G.) & Butler (K. D.). **Inflorescence blight of the Date Palm.**—*J. agric. Res.*, lvii, 4, pp. 313–318, 2 pl., 1 fig., 1938.

An inflorescence blight was found to attack a comparatively wide range of varieties of date palms from 11 to 31 years old in southern Arizona in 1935. The primary infection, which may occur anywhere on the rachis, results in water-soaking, discoloration, and shrinking of the infected tissues; the flowers are killed either through direct attack or by infection of the branches below them; diseased stalks often break under the increasing weight of the fruit. Blocks of tissues from infected parts yielded a pathogenic species of *Helminthosporium*, which is not considered in the present paper, and two species of *Fusarium*, one of which was identified by Sherbakoff and by the Centraalbureau voor Schimmelcultures as *F. moniliforme* (*Gibberella moniliformis* [*G. fujikuroi*]), and the other as *F. semitectum* by the former authority and as *F. lateritium* var. *fructigenum* [*F. lateritium*] by the latter. The perithecial stage of *G. fujikuroi* was produced in culture. Numerous inoculations with the two species of *Fusarium* gave mostly positive results; green date fruits were vigorously attacked by both species after being sprayed with spore suspensions of these fungi. Observations indicate that the weather in the Salt River Valley during the flowering season is usually favourable for the development of the disease. The pathological histology is briefly described. Removal of all staminate flower clusters after pollination is effected and of all pistillate raches after the fruit is harvested is tentatively recommended for control together with spraying of the palms before the spathes open, though experiments have not been specifically carried out.

WALLACE (G. B.). **Report on plant pathology.**—*Rep. Coffee Res. & Exp. Sta., Lyamungu, Moshi, 1937* (*Pamphl. Dep. Agric. Tanganyika* 22), pp. 50–51, 1938.

In continued tests of fungicides for the control of *Hemileia* [*vastatrix*] on Arabica coffee [*R.A.M.*, xvii, p. 315] in Tanganyika, Bordeaux mixture (1·0 and 0·5 per cent.) gave better results than a proprietary soluble copper hydroxide fungicide, and all three were better than the untreated controls. The *Hemileia* disease, first observed near Tukuyu in 1936, continued to spread in the Southern Highlands province. Damping-off of coffee cuttings and seedlings in frames and boxes, associated with a species of *Rhizoctonia* [loc. cit.], has been kept within reasonable bounds chiefly by preventive measures. The parasite does not invariably cause the death of the young plants and the great majority can be preserved by improving the cultural conditions. No further damage arises after the young plants are transferred from the frames to the field.

GHESQUIÈRE [J.]. **Rapport annuel pour l'exercice 1937. Division de Phytopathologie et d'Entomologie.** [Annual report for the financial year 1937. Division of Phytopathology and Entomology.]—*Publ. Inst. nat. Étud. agron. Congo Belge* (hors sér.), pp. 19–26, 2 figs., 1938.

During 1937 coffee at Bukavu, Belgian Congo, showed nodular fasciation apparently due to a bacterium close to *Bact. tumefaciens*. Fungi attacking coffee at Kivu and Ituri included *Hemileia vastatrix*, *Cercospora coffeicola*, *Glomerella cingulata*, *Fusarium* aff. *coffeicola*, *Rigidoporus microporus* [*Fomes lignosus*], and *Corticium salmonicolor*. *Cercospora coffeicola* was prevalent chiefly in excessively damp or shady plantations. Infection by *G. cingulata* was very intense in the south of Kivu, on trees surrounded at the collar with undecomposed compost and manure. Coffee treated experimentally in this way became infected by either *C. coffeicola* or *G. cingulata* if these happened to be prevalent in the vicinity.

S'JACOB (J. C.). **Voedingsphysiologische onderzoekingen bij Coffea arabica L.** [Nutritional-physiological studies on *Coffea arabica* L.] —*Arch. Koffiecult. Ned.-Ind.*, xii, 1, pp. 1–48, 23 figs., 1938. [English summary.]

In water-culture experiments at the Besoeki Experiment Station, Java, to determine the nutritional requirements of coffee, Shive's synthetic solution (*Physiol. Res.*, i, 1914) was the only one of several tested containing the necessary elements for the growth of the plants.

In the course of preliminary tests boron deficiency was found to induce malformation of the young leaves, and blackening and dying-off of the terminal bud in coffee and *Salvia officinalis*. Lack of nitrogen results in the development of stunted coffee plants with yellowish-green leaves. Calcium deficiency causes severe root damage and the development of slipper-shaped leaves, followed by premature death of the plants. Calcium excess is not harmful in the form of calcium chloride, but as calcium carbonate it induces foliar chlorosis and causes a decline

in the acidity of the medium with resultant diminution of iron availability. Since only minute quantities of potassium are requisite for the normal growth of coffee, the lack of this element is not generally strikingly apparent but may be manifested by the formation of small, dry, grey spots on the leaf margins. Excess of potassium causes a light yellow mottling and premature dying-off of the foliage and shortening and thickening of the roots. Neither deficiency nor excess of phosphorus produced any adverse effects. A typical spotting of a restricted zone of the leaves was observed in plants deprived of magnesium, while an excess of this element caused general debility and slight chlorosis. Yellowish, convex leaves and small, thin roots are characteristic of plants suffering from sulphur deficiency. Excess of sulphur induced symptoms resembling those due to too high a total concentration of the culture solution. A reddish-brown foliar discoloration and marginal dryness are typical of plants receiving a superabundance of sodium chloride, the leaves being convex and hanging down the stem. Iron deficiency induces a yellowing of the leaves and pale green veins.

In a series of tests to determine the influence of ammonium salts as a source of nitrogen on the growth of coffee, serious damage occurred at a lower P_H than 4·5 to 5, the lower leaves developing greyish-brown margins while the upper ones become convex and yellow.

Plants grown in highly concentrated (5×) solutions contracted symptoms closely resembling those of 'pseudonodule formation' as described by De Fluiter (*Bergcultures*, x, p. 1612, 1936).

CASTELLANI (E.). **La ruggine del Caffè nel Harar.** [Coffee rust in Harar.] —Reprinted from *Agricoltura colon.*, xxxii, 8, 11 pp., 3 figs., 1 map, 1938.

During a journey in Italian East Africa along the valley of the Auasc to Arba, and thence to Harar and Errer the author observed that the most prevalent diseases of coffee (*Coffea arabica*, Moka Harrar type) were *Hemileia vastatrix* [cf. *R.A.M.*, xvi, p. 379], first observed at Gololcià in 1930, and *Cercospora coffeicola*. Rust-resistant types were observed, of which that referred to as 'Street' has dense, dark, large leaves, while the 'Timpon' type has marked resistance to rust, but is more susceptible to drought and shows less regularity in production. Proceeding northwards from Gololcià the author observed *H. vastatrix* in practically every locality where coffee was grown. At the higher altitudes, no serious damage was caused, but lower down, and especially along the rivers, infection was more severe. In the vicinity of Harar (altitude, 1,800 to 1,950 m.) the disease was not causing serious damage. The worst attacks were found at Errer (1,020 m.) where infection was extremely severe, being favoured by unsuitable climatic conditions and cultural practices. It is concluded that, taking the country as a whole, *H. vastatrix* need not be regarded as constituting a limiting factor in coffee production. The disease can be controlled by adopting suitable measures. Plantations of *C. arabica* should be situated at altitudes between 1,400 and 2,000 m., and should be brought under the best possible cultural conditions. In new plantations, resistant types should be planted.

ANDREWS (F. W.). **Investigations on black-arm disease of Cotton under field conditions. III. The mode of infection of the newly planted crop.**—*Emp. J. exp. Agric.*, vi, 23, pp. 207–218, 1 graph, 2 maps, 1938.

Further investigations carried out in the Anglo-Egyptian Sudan into cotton blackarm [*Bacterium malvacearum*] [already noticed in part from another source: *R.A.M.*, xvii, p. 521] showed that at most only a quarter of the soiled seed left on the ground at the end of the picking season germinates during the rains, equivalent to a possible 5 lb. viable seed-cotton per acre. Possibly only a very small proportion of these seeds give rise to inherently infected seedlings, and a greater proportion are probably infected by rain-splash from infected debris in the vicinity. The potentialities of this infected material are thought to be considerable. The introduction of the disease into areas not previously sown to cotton was found to be due to the presence of seed cotton introduced by the native workers, cotton seeds and seedlings from this material, and old stalks, which had been used as fuel.

The observations clearly demonstrated the impossibility of raising clean cotton plants in the Gezira area, even in localities where cotton has not before been grown. The sowing-seed in the areas observed was free from disease; the bacteria in infected leaves cannot survive the weathering of the pre-sowing period, and as wind-blown debris consists almost wholly of leaves, it is apparent that infection must have been due to the introduction of infective material by human beings. Legislative measures to prevent this would, under the local conditions, be unavailing. Until a blackarm-resistant strain has been developed, the most that can be done is to adopt such practical remedial measures as will keep the disease within reasonable bounds.

NEAL (D. C.) & LOVETT (H. C.). **Further studies of crinkle leaf, a disorder of Cotton plants prevalent in Lintonia and Olivier silt loam soils of Louisiana.**—*Phytopathology*, xxviii, 8, pp. 582–587, 2 figs., 1938.

Further studies on crinkle leaf of cotton in Louisiana [*R.A.M.*, xvii, p. 317] showed that the disease is associated with high soil acidity, calcium deficiency, and manganese toxicity. It is readily corrected by calcium and other basic carbonates, but evidence was obtained that it is not due to calcium deficiency *per se*. When calcium was supplied in pot and field tests in the form of calcium sulphate in amounts adequate for nutritional requirements it failed to control the disease, probably because the P_H value of the treated soil remained unchanged (4·8 to 5), and so permitted manganese to remain in solution and exercise a toxic effect. At the higher P_H value produced by treating the soil with the basic carbonates (calcium, magnesium, and potassium carbonates), the manganese appeared to be precipitated, and the plants remained healthy. The fact that the soil in the affected localities has a consistently lower P_H value and contains significantly more manganese than the soil in healthy areas indicates that the condition is attributable to manganese toxicity. This view was confirmed when typical symptoms were produced in cotton plants in sand cultures by adding increasing amounts of manganese sulphate.

Greathouse (G. A.). **Suggested rôle of alkaloids in plants resistant to Phymatotrichum omnivorum.**—*Phytopathology*, xxviii, 8, pp. 592–593, 1938.

Preliminary studies having indicated the presence of alkaloids in crude extracts from the roots of plants resistant to *Phymatotrichum omnivorum* [*R.A.M.*, xvii, p. 673] a number of these substances were isolated and shown to inhibit the growth of the fungus even in concentrations lower than that found in the plant tissue. A study of the literature of alkaloids showed that of 125 species of plants in which alkaloids have been reported 0, 2, 40, 44, and 39 were extremely susceptible, highly susceptible, moderately susceptible, resistant, and immune, respectively, representing 0, 0·55, 4·56, 10·92, and 9·56 per cent., respectively, of the total ratings from 2,116 plants placed in these groups.

Neal (D. C.) & Haddon (C. B.). **A promising wilt-resistant long staple Cotton.**—*J. Amer. Soc. Agron.*, xxx, 8, pp. 644–646, 2 figs., 1938.

Details are given of a new selection of Delfos cotton, 2323–965–425, made by the junior author at the Northeast Louisiana Experiment Station in 1934, which has showed outstanding resistance to wilt (*Fusarium*) [*vasinfectum*: *R.A.M.*, xvii, p. 525 and next abstracts] in three years' tests at Baton Rouge. In 1937 it showed only 0·5 per cent. infection among a total population of over 600 plants, compared with 63 per cent. in a Half and Half stand comprising 516.

Young (V. H.). **Control of Cotton wilt and 'rust', or potash hunger, by the use of potash-containing fertilizers.**—*Bull. Ark. agric. Exp. Sta.* 358, 26 pp., 1 map, 1938.

In plot experiments on the control of cotton wilt (*Fusarium vasinfectum*) [see next abstracts], carried out over a period of nine years (1929 to 1937) in 15 different sites in Arkansas, on the susceptible cotton varieties Trice 304, Missdel 2, 3, and 4, Arkansas Acala 37, and the moderately resistant Arkansas Rowdens 40, 2119, and 2088, fertilizers containing potash reduced the incidence of wilt and gave complete control of the 'rust' or potash deficiency disease of cotton [*R.A.M.*, xvii, p. 110] in all but two cases, one of which was a site severely infested with root knot nematodes (*Heterodera marioni*). Full data on the results obtained with potash alone or in various combinations with nitrate of soda and superphosphate are given. Applications of potash alone, either as kainit (which was the most efficient of all the fertilizers tested) or muriate of potash often gave better control of wilt on both the susceptible and the resistant varieties of cotton than mixed fertilizers containing the same amount of potash, yet the latter gave better yields. Applications of higher amounts of potash were more effective than low amounts but excessively high amounts did not give correspondingly better results. The effectiveness of potash fertilizers varied greatly at different sites under different environmental conditions. The lowest incidence of wilt occurred when a moderately resistant variety was treated with potash-containing fertilizers, except when nematodes were present. Nitrate alone had no effect, but acid phosphate and nitrate and acid phosphate alone seemed to increase both wilt and

'rust'. Cottonseed meal did not control either of these diseases, but stable manure, used at the rate of 10 tons per acre, gave marked control of 'rust' and a slight decrease of wilt. There was some evidence that potash applications were cumulative in their effect on the control of both wilt and 'rust', whereas fertilizers lacking potash resulted in increasingly greater damage from both diseases.

MILLER (P. R.) **A survey of Cotton seedling diseases and the fungi associated with them.**—*Plant Dis. Reptr*, xxii, 13, pp. 260–263, 3 maps, 1938. [Mimeographed.]

Out of 344 plantings made from cotton seedlings affected with damping-off and collected at random in Virginia, North Carolina, South Carolina, Georgia, Alabama, Mississippi, Louisiana, Texas, and Tennessee, *Glomerella gossypii* [*R.A.M.*, xvi, p. 314] was isolated 283 times, *Fusarium moniliforme* [*Gibberella fujikuroi*] 239, and *Rhizoctonia* [*Corticium*] *solani* 44. *G. gossypii* was predominant in samples from every State except Texas. Other fungi found comprised *F.* spp., *Pythium* spp. (a species of *P.* being predominant on a few samples from limited localities in South Carolina and Tennessee collected during cold, wet weather), *Diplodia gossypii*, *R. bataticola* [?*Macrophomina phaseoli*], *F. vasinfectum* [see preceding and next abstracts], and *Sclerotium rolfsii*. *C. solani* appeared to be more important as a seedling pathogen in Mississippi and Louisiana than in the other States. Comparative counts of seedlings from treated and untreated seed showed that three times as many plants survived when the seed had been treated as when it was untreated. The lesions found on seedlings from treated seed were generally small and superficial.

LLOSA (T.). **Investigaciones referentes al 'wilt' del Algodonero y nuevo método para aislar hongos del tipo Verticillium o Fusarium de plantas atacadas por el 'wilt' del Algodonero.** [Investigations on Cotton 'wilt' and a new method of isolating fungi of the *Verticillium* or *Fusarium* types from plants infected by Cotton 'wilt'.]—*Bol. Estac. exp. agric., Lima*, 13, 22 pp., 3 figs., 1938. [English summary.]

A species of *Verticillium* [see next abstract] has been isolated from the vascular tissues of wilted cotton plants in Peru and is thought to be probably the primary agent of the disease, *Fusarium* [*vasinfectum*: *R.A.M.*, xiii, p. 231 and preceding abstracts] being of secondary importance, though its rapid growth on the standard potato broth dextrose agar medium is liable to obscure and suppress the development of the *Verticillium* in cultures from infected roots. A strongly acid concentration of the medium (P_H 3·1) is unfavourable to the growth of the *Verticillium* but promotes that of *F. vasinfectum*. The filtrates of two strains of each of the fungi under investigation were toxic to the cotton plants tested.

Detailed directions are given for the isolation of the cotton wilt fungi from the petioles instead of the roots, adventitious fungal contaminants being thereby eliminated and the risk of erroneous interpretations obviated.

SAREJANNI (J. A.). **La verticilliose du Coton en Grèce.** [Cotton verticilliosis in Greece.]—*Ann. Inst. phytopath. Benaki, Greece*, ii, 2, pp. 79–85, 1936 [issued 1938].

Cotton wilt (*Verticillium albo-atrum*) [*R.A.M.*, xvii, pp. 504, 814, and preceding abstract], first observed in Greece in 1932 [ibid., xiii, p. 632], is stated to be now widespread in the country, doubtless on account of the extended cultivation of the susceptible American varieties, Acala, King, Trice, and Ingold, in place of the apparently immune native Dadiotico (*Gossypium herbaceum*). The symptoms of the disease are described and the taxonomy of the causal organism briefly discussed. In Greece outbreaks of wilt are liable to occur towards the end of June or early in July and again about the end of September, the former being much more severe than the latter and occasionally causing up to 70 per cent. infection in the plantations of Livadia, though as a rule the incidence is under 10 per cent. In the laboratory, cultures of *V. albo-atrum* remained viable for three years without subculturing and withstood temperatures exceeding 40° and below 0° C. The extraordinary rapidity with which the disease has spread in Greece is considered to point either to the seed or to the aerial transport of conidia as the main source of infection, dissemination through the soil, if it occurs at all, being of little importance.

CARTWRIGHT (K. ST G.). **A further note on fungus association in the Siricidae.**—*Ann. appl. Biol.*, xxv, 2, pp. 430–432, 1938.

A fungus isolated from the glands, eggs, and oviposition and larval tunnels of *Sirex gigas* has been identified as *Stereum sanguinolentum* [*R.A.M.*, xiii, p. 341; xvii, p. 715], while a very similar fungus isolated from *Sirex cyaneus* is believed to be a form of the same species. There is very strong evidence indicating that in England only one species of fungus is associated with each of these insects. Under moisture conditions in the wood favourable to the larvae only slow development of the fungus can take place generally, but at a higher humidity rapid growth of the fungus occurs, with apparently fatal results to the larva of *S. gigas* in one instance. The fungus was found to be present in glands at the base of the ovipositor in late-stage female pupae and is introduced into the wood during oviposition.

Isolations from larval tunnels and from glands of an adult female *Xiphydria prolongata* yielded a culture resembling *Daldinia concentrica*.

PUNTONI (V.). **Studi sul genere Trichosporon.** [Studies on the genus *Trichosporon*.]—*Mycopathologia*, i, 3, pp. 169–181, 4 pl., 1938. [English summary.]

This is an expanded version of the author's recent paper [*R.A.M.*, xvii, p. 599], in which he redefined the genus *Trichosporon* and gave descriptions of six species. In addition he now suggests the segregation of a third suborder of the Thallosporales, Blasto-arthrosporineae, to include the Trichosporaceae, with the genus *Trichosporon*.

REDAELLI (P.), CASTELLI (T.), & CIFERRI (R.). **Presence of Mycotorula albicans and Blastodendrion krausi in Italian home-made bread yeast.**—*Mycopathologia*, i, 3, pp. 182–184, 1938.

A brief account is given of two asporogenous yeasts, namely, *Myco-*

torula [*Candida*] *albicans* [*R.A.M.*, xvii, p. 817] and *Blastodendrion krausi*, which in 1936 were isolated by one of the authors from samples of home-made baker's yeast in Italy. This is believed to be the first record of the occurrence of these organisms in yeast.

BOEDIJN (K. B.) & VERBUNT (J. A.). **Annotations about dermatomycoses in Batavia.**—*Mycopathologia*, i, 3, pp. 185–198, 6 pl., 4 figs., 1938.

Following a discussion on the incidence of dermatomycoses in Batavia, a list is given, with full annotations, including clinical observations, of eight pathogenic fungi isolated by the authors from patients in 1935–6, namely: *Epidermophyton rubidum* [*Trichophyton rubrum*], *E.* [*T.*] *interdigitale*, *T. plicatile* [*R.A.M.*, xvi, p. 458], *Favotrichophyton* [*T.*] *ochraceum* [ibid., xvii, p. 395], *F. decipiens* n.sp., *Mycotoruloides unguis*, *Proteomyces variabilis* n.sp., and *Piedraia javanica* n.sp. Latin diagnoses of the new species are appended.

F. decipiens forms effuse, cerebriform cultures, with elevated centre and radiating margins, slightly pubescent, and of a dirty brownish-purple colour. The mycelium is septate, branched, and undulate; the chlamydospores are numerous, terminal, lateral, or sometimes intercalary, globose at first but oval to elliptic when ripe, thick-walled, and 17·5 to 32 by 12 to 20 μ in diameter. In old cultures the cells of some hyphae swell to form arthrospores, either globose, 5 to 11 μ in diameter, or elongated, 11 to 15 by 7 to 10 μ.

Proteomyces variabilis is characterized by vermiculate, dirty ochraceous cultures, with branched, septate mycelium varying considerably in diameter and breaking up into blastospores; the latter are 4 to 17 μ long, and produce numerous buds. Giant cells, 20 to 34 μ in diameter, are also present.

Piedraia javanica forms hard, black nodules on the hairs, which by confluence may attain a length of 750 μ and a thickness of 130 to 187 μ. The tissue is pseudoparenchymatous, consisting of dirty brown cells arranged in regular vertical rows. In the ripe stroma, globose to slightly elongated locules are formed, 50 to 100 μ in diameter, each containing a few asci. The asci are 8-spored, broadly elliptical, shortly stalked, and thin-walled, and the ascus wall soon disappears by deliquescence. The spores are hyaline and very variable in shape and size from long-cylindrical to more or less curved, and from 20 to 60 by 4 to 12 μ in diameter; each spore is surrounded by a thin membrane prolonged at the ends into straight or curved appendages, 2 to 28 by 1·5 to 3·5 μ.

CATANEI (A.). **Sur la place des Trichophyton violaceum et glabrum dans la classification.** [The position of *Trichophyton violaceum* and *T. glabrum* in classification.]—*Mycopathologia*, i, 3, pp. 199–200, 1938.

The author states that 17 out of the 41 strains of *Trichophyton violaceum*, and 12 out of the 24 strains of *T. glabrum* [*R.A.M.*, xvii, p. 818] studied by him in culture on rice-flour agar, produced conidia of the *Acladium* type, thereby confirming the correctness of the assignment of these organisms to the endothrix section of the genus *Trichophyton*. Evidence is further adduced showing that these two species are distinct from one another.

CIFERRI (R.), VERONA (O.), & SAGGESE (V.). **Reisolamento della Pseudomycoderma matalense e revisione del gruppo.** [A new isolation of *Pseudomycoderma matalense*, and a revision of the group.]—*Mycopathologia*, i, 3, pp. 212–223, 1 pl., 1938.

The authors state that the results of comparative morphological, cultural, biochemical, and pathogenicity studies [details of which are given] showed that a fungus, isolated by one of them in Italy from the faeces of a child suffering from chronic enterocolitis, is identical with the original strain of *Geotrichum* (*Oidium*) *matalense* preserved at the Centraalbureau voor Schimelcultures in Baarn, and also with *G. matalense* var. *chapmani* [*R.A.M.*, xii, p. 117]. The work is further claimed to have justified the reference of *G. matalense* by Ciferri and Redaelli to the genus *Pseudomycoderma* (*Arch. Mikrobiol.*, vi, 1, pp. 9–72, 1935), but a review of the systematic position of this genus leads them to reduce it to the rank of a subgenus of *Geotrichum*. The latter genus is the only one possessing an arthrosporous form of multiplication, never forming blastospores, and its subdivision is now suggested, on the basis of the relative amounts of arthrospores formed in relation to the mycelial hyphae, into the following three subgenera: (1) *Berkhoutia*, forming powdery colonies, with mycelium poorly developed, and completely absent at maturity, all the hyphae being transformed into arthrospores by schizogenesis; (2) *Eugeotrichum*, with well-developed mycelium even at maturity, and in part persistent; the mycelial hyphae are only in part reduced to arthrospores and the colonies are typical of *Geotrichum*; (3) *Pseudomycoderma*, with mycelium very abundant at any stage of growth, and dominant over thallospores; arthrospores are rare or very rare, and there is a strong tendency to reduce the colonies to a purely mycelial type.

The Italian strain of *G. matalense* was shown experimentally to be slightly more pathogenic to rabbits than the other two strains studied, but the part played by it in the child's disease still remains to be determined.

LACAZ (C. DA S.). **Chromomycoses.**—*Brazil-med.*, lii, 24, pp. 555–560; 25, pp. 578–583, 6 figs., 1938. [Abs. in *Trop. Dis. Bull.*, xxxv, 11, p. 832, 1938.]

This is a general account of chromoblastomycosis in Brazil, beginning with the earliest records of the disease, attributed to *Hormodendrum* [*R.A.M.*, xvii, p. 819] by A. Pedroso and J. M. Gomes in 1911, the species *H. pedrosoi* [ibid., xvii, p. 747] having been named by Brumpt in 1922. Fungi subsequently implicated in the etiology of the disorder include *Phialophora verrucosa* [ibid., xvii, p. 821] and *Acrotheca* [ibid., xvi, p. 99]. Particulars are given of the local distribution of the 48 cases so far observed in the country.

MOORE (M.). **Blastomycosis, coccidioidal granuloma and paracoccidioidal granuloma: comparative study of North American, South American and European organisms and clinical types.**—*Arch. Derm. Syph., Chicago*, xxxviii, 2, pp. 163–190, 11 figs., 1938.

This is a descriptive account and critical discussion of the clinical

aspects, appearance in the host tissues or pus, cultural features (macro- and microscopic), and biological characters of the fungi associated with blastomycosis and coccidioidal granuloma in Europe and North and South America. The following classification is used: coccidioidal granuloma (Posada's disease, 1892, Rixford and Gilchrist, 1894) due to *Coccidioides immitis* [*R.A.M.*, xvii, p. 528]; North American blastomycosis or Gilchrist's disease, 1894, caused by *Zymonema* (*Endomyces*) *dermatitidis*, *Z. capsulatum* (*E. capsulatus*) and its var. *isabellinus* [ibid., xvii, p. 394]; European blastomycosis (Busse-Buschke's disease, 1894) caused by *Cryptococcus hominis*, *Atelosaccharomyces hominis*, or *Torulopsis* [*Debaryomyces*] *neoformans* [ibid., xvii, p. 677]; and South American blastomycosis (also known as paracoccidioidal granuloma or Lutz-Splendore-de Almeida disease, 1908) due to *Paracoccidioides brasiliensis* [ibid., xvii, p. 598], *P. tenuis* Moore n.sp., or *P. cerebriformis* Moore (in *Rev. Biol. Hyg., S. Paulo*, vi, p. 148, 1935).

P. tenuis [Latin and English diagnoses of which are given] is characterized by a general resemblance to *P. brasiliensis* both in the host tissues and in culture except for the proportionately smaller dimensions of its hyphae (1 to 3·5 μ in diameter), spherical, sclerotic, and intercalary cells (5 to 20, 5 by 7 to 15 by 20, and up to 10 μ in diameter, respectively), chlamydospores (usually 5, occasionally up to 10 μ in length, 4 to 10 μ in diameter), hyphal swellings (4 μ), terminal hypnospores (7 to 12, rarely 7 by 25 μ), and lateral, sessile, or pedicellate conidia (5 μ). Racquet mycelium is present. The fungus generally makes good though slow growth on artificial media, except Czapek's agar; the colonies are white at first, turning light tan, compact, verrucoid, vermiculate, and somewhat cerebriform, with a raised to umbilical centre, showing folds or radiating ridges. *P. tenuis* does not ferment carbohydrates, liquefy gelatine, or coagulate litmus milk.

KAYE (H.). **A case of rhinosporidiosis of the eye.**—*Brit. J. Ophthal.*, xxii, 8, pp. 449–455, 5 figs., 1938.

Full clinical details are given of a case of rhinosporidiosis of the eye [*Rhinosporidium* (?) *seeberi*: *R.A.M.*, xvi, p. 534] in a 16-year-old European boy at Johannesburg, South Africa, in which country the disease is stated to be exceedingly rare in man, this being only the fifth record of its occurrence.

TRUNINGER (E.). **Über die Verwendung von Bor als Vorbeugemittel gegen das Auftreten von sogenannten Kalkschädigungen bei Pflanzen.** [On the use of boron as a prophylactic against the development of so-called lime injuries in plants.]—*Schweiz. landw. Mh.*, *1938*, 6–7, pp. 196–211, 5 figs., 1 graph, 1938.

A fully tabulated account is given of the writer's successful pot experiments at the Federal Agricultural-Chemical Institute, Liebefeld, Berne, on the prevention, by the admixture with the soil of boric acid at rates corresponding to 10 kg. per hect., of lime-induced chlorosis of flax and various abnormalities in mustard, cress, red and white radishes, carrots, and spinach due to the unbalanced absorption of lime, either when used as a fertilizer or occurring in tap water.

Calinisan (M. R.). **Vascular disease of Abacá (Manila Hemp) in Davao: progress report No. 1.**—*Philipp. J. Agric.*, ix, 2, pp. 153–157, 159–160, 11 pl., 1938.

From abacá (*Musa textilis*) plants suffering from a vascular disease characterized by symptoms resembling those of Panama disease due to *Fusarium oxysporum* f. 3 [*F. oxysporum* var. *cubense*: *R.A.M.*, xvii, p. 40] in various parts of the Philippines, the writer has isolated in pure culture bacteria (present in the xylem vessels, parenchymatous cells, and phloem) and the above-mentioned fungus, which was commonly localized in the pseudo-stem. A weevil, *Odoiporus paganus*, has also been found associated with the disease, and inoculation experiments with all three organisms are in progress. Of 306 plants examined, 109 (35·62 per cent.) showed joint disease and insect infestation, 173 (56·63 per cent.) vascular disease alone, and 24 (7·84 per cent.) the weevil alone. The disease was first observed in 1931–2 in the Upper Bayabas, Guianga District, at an altitude of 3,000 to 3,600 ft. above sea-level, whence it rapidly spread to lower elevations; up to 31st July, 1937, the total infected area was estimated at 309·43 hect. and the aggregate value of the damage at 200,000 to 300,000 pesos [1 peso = 2*s.* 0·6*d.* at par]. A subsidy of 6,000 pesos towards the work of eradication has been granted by the responsible authorities.

Beaumont (A.) & Buddin (W.). **Notes on Fusarium avenaceum attacking the leaves of Tulips in glasshouses.**—*Trans. Brit. mycol. Soc.*, xxii, 1–2, pp. 113–115, 1938.

Small lesions, up to 1 cm. across, observed on leaves of the tulip variety William Copland in a greenhouse near Exeter in 1931 and 1932, were associated with a fungus identified by Dr. H. W. Wollenweber as *Fusarium herbarum* var. *tubercularioides* [*R.A.M.*, xiv, p. 366], a species later included by the same authority in *F. avenaceum* [ibid., xiv, p. 709]. The same fungus was isolated by E. R. Wallace from tulip leaves in Lincolnshire in 1931 and it has also been seen in Berkshire, Hampshire, Middlesex, and Oxfordshire. Field observations, confirmed by inoculation experiments, showed that the disease was favoured by high temperatures (70° C. or over) and high humidity (80 to 100 per cent.), and is, therefore, unlikely to develop outside greenhouses, where it is, with rare exceptions, of only minor importance. Under favourable conditions spore masses are found on the spots on the leaves; in the absence of spores the spots can be easily mistaken for those caused by 'fire' [*Botrytis tulipae*], but they do not develop on the flowers and are less numerous and conspicuous. The common habit of using straw, on which the fungus can persist and increase, to cover the boxes of bulbs during rooting, and particularly the use of the same straw during several seasons, is considered to favour the development of the disease. Cultures of the fungus from tulip proved highly pathogenic to wheat. The use of clean straw and correct regulation of temperature and humidity in the greenhouse are recommended for the control of the disease.

Guard (A. T.). **Studies on control of Tulip blight.**—Abs. in *Proc. Ind. Acad. Sci.*, xlvii, p. 73, 1938.

Tulip bulbs treated with 2 per cent. formaldehyde and planted in

clean soil were completely freed from the mycelium and sclerotia of *B[otrytis] tulipae* [*R.A.M.*, xvii, pp. 96, 112], whereas naphthalene, though inhibiting the growth of the fungus, was not lethal. Neither preparation damaged the bulbs at the concentrations tested.

McCulloch (Lucia). **Leaf blight of Iris caused by Bacterium tardicrescens.**—*Phytopathology*, xxviii, 9, pp. 642–649, 2 figs., 1938.

Further particulars, including a technical description of the agent, are given of the leaf blight of iris caused by *Bacterium tardicrescens* [*R.A.M.*, xvi, pp. 463, 677], now known to occur on varieties mostly of the bearded group in Virginia, Maryland, District of Columbia, and other regions extending from Alabama to Massachusetts. In addition to the information already summarized, it is mentioned that inoculations by spraying outdoor iris plants with a suspension of the bacteria resulted in the formation after three weeks of small, yellow spots on the leaves but after a rainy period considerable infection developed. The chief factor in promoting good infection was a moist atmosphere for five or six days; wounding the leaves was not only unnecessary but often detrimental to infection. The minimum, optimum, and maximum temperatures for the growth of the organism are about 5°, 26° to 27°, and 32° C., with a thermal death point at 44° to 46°. *Bact. tardicrescens* survived exposure to a temperature of —17·8° to —20° for 17 months, at the end of which time it was strongly pathogenic in inoculation tests on bearded irises. Desiccation on cover glasses at 27° was resisted for five to six days, rarely longer, while five minutes or less in direct sunlight sufficed to destroy the organism. Control measures should therefore be largely based on exposure of the soil to sun and drying conditions. The optimum hydrogen-ion concentration for development on beef media was found to lie between P_H 6·5 and 7. Positive results were obtained in inoculation experiments with *Bact. tardicrescens* on *Iris cristata*, *I. sibirica*, *I. missouriensis*, *I. kaempferi*, *I. tenax*, *I. orientalis*, and the blackberry lily (*Belamcanda* sp.).

Green (D. E.) & Wilson (G. F.). **Pests and diseases of bearded Irises.**—*Gdnrs' Chron.*, civ, 5094, pp. 114–116, 3 figs. (2 on pp. 113, 117), 1938.

In descending order of importance, the chief diseases of bearded iris in England are rhizome rot (*Bacillus carotovorus*) [*Erwinia carotovora*: *R.A.M.*, xiv, p. 698; xvi, p. 182], leaf spot (*Heterosporium gracile*) [?*Didymellina macrospora*: ibid., xvii, p. 750], basal grey mould, due to a species of *Botrytis* [cf. ibid., xvi, p. 750], and scorch, the cause of which has not yet been ascertained [ibid., xiv, p. 698].

The control of rhizome rot consists in the prompt removal and burning of all infected material, dusting the cut surfaces and remaining rhizomes with copper-lime dust, and sprinkling the same dust on the adjacent soil; soil dressings of superphosphate of lime are very beneficial.

Spraying with a mixture containing copper helps to check leaf spot, but infection can generally be avoided by removing and burning all diseased and dying leaves in the autumn and again in spring.

Basal grey mould starts in late spring at the base of the fans as a yellow patch, and quickly develops into a grey mould. In a wet, cold spring even the most vigorous fans may be killed. Smooth, black

sclerotia overwinter in the soil, and reinfect the young fans in the following year. Affected fans should be immediately cut down near the ground and burnt.

Scorch may be recognized when the top three or four inches of nearly all the leaves droop and turn a reddish-chocolate colour. The condition generally develops during the first spell of hot, dry weather in early summer. Most of the roots are hollow, rotting away in winter or early spring, but the rhizome itself is normal. Affected plants should be lifted and the roots removed, the rhizomes washed or soaked in potassium permanganate, and the plants replanted either in a well-drained situation or on the old site, after this has been deeply dug and improved; as a further precaution, Cheshunt compound may be used for watering in.

GREGORY (P. H.). **Sclerotinia polyblastis n.sp. on Narcissus the perfect stage of Botrytis polyblastis Dowson.**—*Trans. Brit. mycol. Soc.*, xxii, 1–2, pp. 201–203, 1938.

English and Latin diagnoses are given of *Sclerotinia polyblastis* n.sp., designated as the perfect stage of *Botrytis polyblastis* Dowson [*R.A.M.*, xvii, p. 42], on the basis of the following observations. Nine single ascospore cultures were isolated from apothecia of a *Sclerotinia* collected in February 1938 in the Scilly Isles on the overwintered leaves of narcissus of the 'Soleil d'Or' variety, which had been killed by 'fire' (*B. polyblastis*) in the previous summer. These ascospore cultures on prune or oatmeal agar resembled those from single conidia of *B. polyblastis* in general appearance as well as in microscopic characters, particularly the production in sporodochia of great numbers of slimy phialospores (microconidia), which were apparently unable to germinate. Under conditions so far tested neither the ascospore cultures from the *Sclerotinia* nor the conidial cultures of *B. polyblastis* produced any conidia of *Botrytis*, but when healthy, uninjured narcissus flowers in moist dishes were inoculated from each of these single ascospore cultures, large conidia up to 60 μ in diameter developed profusely round the site of inoculation after eight days. Similar conidia developed following inoculations with multiascospore cultures. Finally, single conidia from these inoculated flowers again produced cultures typical of *B. polyblastis*.

The new species has burnt umber-brown, scantily pubescent apothecia; the disk is cyathiform, becoming discoid, 3 to 4 mm. in diameter; the stipe is 3 to 8 mm. long, and tapers to 0·5 mm. in diameter at the umber-brown to blackish base; the asci are cylindrical, 150 to 170 by 7 to 10 μ; the ascospores are uniseriate, ellipsoid, non-septate, hyaline, normally 14 to 20 by 7 to 10 μ, but often abortive and 10 to 14 by 6 to 10 μ, the paraphyses are straight, filiform, septate, with clubbed or somewhat irregular tips; the sclerotia are black, 3 to 8 mm. long, 1·5 to 3 mm. wide, 1 to 1·5 mm. thick, flattened, and embedded in the leaf tissue. The species has also been found at St. Hilary, Cornwall.

WERNHAM (C. C.). **Chlamydospore production on artificial media by Urocystis gladioli.**—*Phytopathology*, xxviii, 8, pp. 598–599, 1 fig., 1938.

Gladiolus bulbs received from Fairview, Pennsylvania, showed the

presence of an organism tentatively identified as *Urocystis gladioli* [*R.A.M.*, xvi, p. 63], apparently the first report of gladiolus smut from America. Germination of the spore balls was obtained in 12 hours by streaking them on potato dextrose agar plates, and in all the cases observed was akin to that of *U. cepulae*. In pure culture the fungus produced a reddish-brown, prostrate mycelium of uniform appearance and large numbers of chlamydospores of the *U. gladioli* type, which germinated in the same manner as those from the corms.

PIRONE (P. P.). **Where are Gardenia cankers initiated?**—*Phytopathology*, xxviii, 8, pp. 597–598, 1 fig., 1938.

Further studies carried out in New Jersey on gardenia stem canker (*Phomopsis gardeniae*) [*R.A.M.*, xvii, p. 398] showed that in a large percentage of cases infection begins at the leaf joints on the base of the cuttings after they are set in the rooting medium. The freshly cut surfaces left when the growers have removed the lower leaves with a sharp knife before embedding the cuttings provide an excellent site of entrance for the fungus and are important foci for later infection.

WHITE (R. P.). **Rhododendron wilt and root rot.**—*Bull. N.J. agric. Exp. Stas* 615, 32 pp., 14 figs., 4 graphs, 1937. [Received November, 1938.]

Continuing his studies on the wilt and root rot of *Rhododendron ponticum* and other *R.* spp. in New Jersey [*R.A.M.*, xv, p. 808], the writer, after recapitulating information already presented, reports the existence of three distinct strains of the causal organism (*Phytophthora cinnamomi*, which in agreement with Mehrlich [ibid., xv, p. 378] he regards as a synonym of *P. cambivora*). The optimum temperature for the growth of all three strains lies between 25° and 27·5° C., but one (No. 17), pathogenic to rhododendrons, consistently withstood high (35°) and low (5°) extremes better than the others. This strain further tolerates a hydrogen-ion concentration of P_H 4·25, at which *R. ponticum* grows better than at lower acidities. In addition to No. 17 the writer distinguishes a strain from *Erica* sp. (New York) and No. 14 (Mehrlich's 466) from Hawaiian pineapples.

PAPE (H.). **Eine noch wenig beachtete Krankheit der Zierpflanzen.** [An as yet little heeded disease of ornamentals.]—*Blumen- u. PflBau ver. Gartenwelt*, xlii, 32, pp. 384–386, 2 figs., 1938.

Hosts of *Phytomonas fascians* [*R.A.M.*, xvii, p. 732] in Germany are stated to include *Chrysanthemum indicum*, *C. maximum*, *Pelargonium zonale*, *Heuchera sanguinea*, *Asparagus sprengeri*, *Buddleia variabilis*, and *Verbascum vernale*. Gall-like accumulations of short, thickened, sometimes banded shoots develop at the stem bases and mostly produce only stunted leaves. So far the disease is without practical importance, the maximum incidence of infection recorded (in *C. indicum*) being 0·5 per cent.

SPRAGUE (R.). **Two Mastigosporium leaf spots on Gramineae.**—*J. agric. Res.*, lvii, 4, pp. 287–299, 5 figs., 1938.

The author considers *Mastigosporium album* var. *calvum* specifically distinct from *M. album* Riess [*R.A.M.*, xvi, p. 230] for the following

reasons: (1) the spores of *M. album* have appendages and four or five cross walls, whereas those of *M. album* var. *calvum* have no appendages and only three cross walls; (2) the former are usually longer and sometimes narrower than the latter; (3) the two fungi maintain their respective characteristics in culture; and (4) the host range of each is fairly distinct. He accordingly proposes to raise *M. album* var. *calvum* to specific rank as *M. calvum* (Ell. & Davis) n. comb. and cites as synonyms *M. album* var. *muticum*, *Fusoma rubricosa* Dearn. & Barth. [apparently the earliest specific name], and *Amastigosporium graminicola*. *M. album* occurs on *Alopecurus pratensis* and *Deschampsia caespitosa* in Europe, but has not been reported from North America. *M. calvum* is widespread on a number of grasses in Europe and America. In northwestern Oregon it is a destructive parasite during mild, rainy weather in the winter and spring, causing a purple flecking and a leaf spot on *Dactylis glomerata* and an eye spot on the leaves of several species of *Agrostis*. In Wisconsin it occurs on species of *Calamagrostis*. The results of inoculation studies indicate that apart from differences in host range *M. calvum* comprises several distinct physiologic races. It is proposed to amend the genus *Mastigosporium* so as to include fungi with short, stipitate conidiophores bearing elliptical, 3- to 5-septate, hyaline, appendaged or not appendaged conidia. No evidence was obtained that *Dilophospora alopecuri* [ibid., xvi, p. 184] is related to *M. album* or *M. calvum*. *M. album* var. *athrix* Eriks. is assigned to *Septogloeum* as *S. athrix* (Eriks.) n. comb. and is believed to be probably identical with *S. oxysporum*.

Parodi (L. R.). **Ustilago perennans parásito de Arrhenatherum elatius cultivado en la Facultad de Agronomía de La Plata.** [*Ustilago perennans*, a parasite of *Arrhenatherum elatius* cultivated at the Faculty of Agronomy of La Plata.]—*Rev. argent. Agron.*, v, 3, p. 188, 1938.

Arrhenatherum elatius [*A. avenaceum*], a fodder grass cultivated for experimental purposes at the La Plata Faculty of Agronomy, has been observed on several occasions since 1923 to be attacked by *Ustilago perennans* [*R.A.M.*, xii, p. 294], not previously recorded from the Argentine.

Ekstrand (H.). **Sclerotium rhizodes, en på gräs förekommande ofullständigt känd sclerotiesvamp.** [*Sclerotium rhizodes*, an imperfectly known sclerotial fungus occurring on grasses.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1938*, pp. 39–41, 1 fig., 1938.

Attention is drawn to the recent occurrence on *Agrostis stolonifera* in Sweden of *Sclerotium rhizodes* [*R.A.M.*, xiv, pp. 39, 766], previously reported in the same country on *A. tenuis* (which is also attacked by the fungus in Norway) and *Calamagrostis lanceolata*. Affected leaves curl up, wilt, and assume a bleached appearance, while the leaf sheaths may also wither, panicle development is arrested, and sometimes the entire shoot ceases to grow. The circular to oblong sclerotia of the fungus measure up to 2 mm. in diameter and resemble those of certain *Typhula* species, e.g., *T. graminum*, to which, according to I. Jørstad, some of the damage really due to *S. rhizodes* is commonly attributed in Norway.

JONES (F. R.). **A seed-borne disease of Sweet Clover.**—*Phytopathology*, xxviii, 9, pp. 661–662, 1938.

In addition to the well-known black stem disease of sweet clover (*Melilotus* spp.) caused by *Mycosphaerella* (*Ascochyta*) *lethalis* [*R.A.M.*, xiii, p. 32], the crop is also occasionally attacked by a less familiar species of *Ascochyta*, *A. caulicola*, recorded in Germany in 1903 (*Arb. biol. Anst.* (*Reichsanst.*) *Berl.*, iii, p. 441) but apparently not hitherto described from the United States. The present report is based both on the examination of herbarium material of 1921 and subsequent years and on field observations in Kansas, Nebraska, Iowa, Illinois, and Wisconsin during 1937. In marked contrast to the blackening of the stems caused by *M. lethalis*, *A. caulicola* produces bleached areas, sometimes surrounded by a brown margin, and accompanied in vigorously growing plants by a bending of the stalks, suggesting the name 'gooseneck' for the disease. Unlike *M. lethalis*, a sparsely fruiting fungus, *A. caulicola* forms a profusion of conspicuous pycnidia on the lesions as soon as they appear. Both fungi may often be found on the same plant. *A. caulicola* has been isolated from all parts of *Melilotus* except the roots, and plants grown from infected seed, though appearing healthy during the winter in the greenhouse, developed numerous lesions about a fortnight after exposure to rainy outdoor conditions, showing that the fungus is to some extent systemic.

RAMSEY (G. B.), BRATLEY (C. O.), & WIANT (J. S.). **Diseases of fruits and vegetables observed on the Chicago and New York markets in 1937.**—*Plant Dis. Reptr*, *Suppl.* 106, pp. 62–82, 1938. [Mimeographed.]

Brief notes are given on a large number of diseases of fruit and vegetables observed in the Chicago and New York markets (by G. B. Ramsey, and by C. O. Bratley and J. S. Wiant, respectively) in 1937.

JOËSSEL (P. H.), LIDOYNE (A.), & PAMPILLON (F.). **Trois années d'essais de traitements contre la chlorose des arbres fruitiers.** [Three years of experiments with treatments against chlorosis of fruit trees.]—*Ann. Épiphyt.*, N.S., iii, 2, pp. 231–246, 1937. [Received October, 1938.]

In continuation of the experiments carried out during the two previous seasons in the south of France on the control of fruit tree chlorosis [*R.A.M.*, xv, p. 515], the authors in 1936 treated 100 affected peach trees by Mokrzecki's and Rassiguier's methods [loc. cit.], using iron pyrophosphate (citro-ammoniacal), ferric potassium tartrate, ferric ammonium citrate, ferric ammonium oxalate, and ferric potassium oxalate. The dosages used for Mokrzecki's method corresponded to 1 gm. or $\frac{1}{3}$ gm. of iron, according to the age of the tree, and for Rassiguier's method a concentration giving the same amount of iron as a 30 per cent. solution of iron sulphate; the iron pyrophosphate and ferric potassium oxalate were used in saturated solution.

Great improvement followed the treatments with ferric ammonium oxalate, with no appreciable injury to vegetation, and this salt could advantageously be used to replace the ferric ammonium citrate, which caused severe injury. Ferric potassium oxalate had a slower and less marked effect than the other salts tested.

A number of severely affected 7-year-old William pear trees were also treated by Mokrzecki's method, using ferric potassium tartrate, iron pyrophosphate, ferric ammonium citrate, ferric ammonium oxalate, and ferric potassium oxalate. One day after the treatment the oldest leaves showed burnt areas and shortly after began to fall, though the young leaves remained uninjured, except on the trees treated with the citrate, which became completely defoliated. All the other treatments subsequently gave greatly improved foliage, as compared with the controls, the fruit ripening normally.

It is concluded that the use of iron salts, especially ferric potassium tartrate, iron pyrophosphate, and ferric ammonium oxalate, restores the green colour of chlorotic peach and pear trees and, for a time, their productive capacity. Insertion of the salts in holes in the trunk gives more marked and lasting results than the painting of pruning wounds or spraying during the vegetative period, but all three methods should be used concurrently, where necessary. On slightly affected trees, or immediately before harvesting, to avoid crop loss, resort may be had to spraying with ferrous ammonium sulphate. In all other cases Mokrzecki's or Rassiguier's method should be used, the latter on very young trees. The dosage recommended is 1, $\frac{1}{2}$, and $\frac{1}{3}$ gm. of iron for trees 8 to 12, 6 to 8, and 3 to 6 years old, respectively.

McWhorter (O. T.). **Zinc treatments for little leaf.**—*Bett. Fruit*, xxxii, 10, p. 5, 1938.

Brief, popular notes are given on zinc treatments used successfully against little leaf of deciduous fruit trees in Oregon since 1933 [*R.A.M.*, xvi, p. 817; xvii, pp. 327, 376]. Old, affected stone fruit trees should be sprayed just before the buds swell with zinc sulphate (50 lb. per 100 gals., or 25 or 30 lb. per 100 gals. if the condition is not severe). Young trees may receive the same treatment during dormancy, but if the dormant spray has been omitted or has failed to give complete control, the foliage should be sprayed about one month to six weeks after it has appeared with zinc sulphate (20 to 25 lb. per 100 gals.), plus one-third as much hydrated lime which should be soaked in water for some hours and added as milk of lime. This spray should be applied early in the morning or late in the afternoon.

Zinc injections, made by boring $\frac{3}{8}$ in. holes $1\frac{3}{4}$ in. deep and 4 to 5 in. apart round the base of the tree, just under the ground line, filling them with powdered zinc to within $\frac{1}{2}$ in. of the outside, and sealing with grafting wax, in the autumn or very early winter, have never failed to give beneficial results, which last about three years. Zinc tacks have given very good results on young cherry, peach, and apricot trees. Zinc strips as used in California have proved difficult to drive into the trees. Zinc dusts and soil treatments are not recommended.

Nightingale (Alice A.). **Some chemical constituents of Apple associated with susceptibility to fire-blight.**—*Bull. N.J. agric. Exp. Stas* 613, 22 pp., 4 figs., 1936. [Received November, 1938.]

A tabulated account is given of experiments in the growth of *Erwinia amylovora* on the extracted juice of apple trees of different varieties in New Jersey, the results of which, though admittedly incomplete, are

thought to justify the conclusion that the development of the organism depends more closely on the relative concentration and equilibrium of the carbohydrate and nitrogenous compounds within the host tissue than on the comparative water content or extent of resistance offered by the physical nature of the host cells. A relatively low carbohydrate, and high nitrogen content was correlated with susceptibility, and the reverse with resistance to fireblight [*R.A.M.*, xv, p. 814].

The growth of the bacterium in test tubes on agar prepared with juices extracted from hard and soft trees of several varieties, including Henry Clay (reputedly resistant), English Codling (more susceptible), McIntosh, Delicious, and Stayman, confirmed the data obtained from greenhouse inoculations on trees receiving complete or non-nitrogenous nutrient solutions. *E. amylovora* developed well on agar made from succulent twigs, low in carbohydrates and high in organic nitrogen, but grew poorly or not at all on that prepared from hard material with a high carbohydrate and low nitrogen content. The addition of asparagin to the hard twig medium favoured the growth of the organism, while the incorporation of sugar with soft twig juice agar acted adversely on its development.

LOEWEL (E. L.) & FRIEDRICH (G.). **Fusikladiumbeobachtungen an eingetüteten Apfelzweigen während der Vegetationsperiode.** [Observations on *Fusicladium* on enclosed Apple twigs during the vegetation period.]—*Gartenbauwiss.*, xii, 2, pp. 121–126, 1 fig., 1938.

With the object of determining the part played by ascospores in the early infection of apple trees with *Fusicladium* [*Venturia inaequalis*: *R.A.M.*, xvii, p. 606] shoots of the varieties Boskoop, Coulon, Signe Tillisch, Gravenstein, Echter Glockenapfel, and Echter Boiken were enclosed in waterproof bags before the beginning of the period of ascospore discharge in Altenland, Germany. During this period (from the beginning of April till the end of May) each of the bags on each tree was removed in turn for a few days and replaced again, except for a few bags which remained on the shoots all the time. At the end of the experiment all bags were removed and the lesions on the leaves counted. It was found that shoots exposed at times of maximum ascospore discharge showed less infection than those exposed at times of less abundant discharge, and the shoots which had remained in the bags all the time and had, therefore, been entirely protected from ascospores showed the greatest number of infected leaves. It is concluded, therefore, that the infection originated from mycelium or spores which must have been present on the shoots prior to the period of ascospore discharge. The bases and petioles of infected leaves showed the oldest lesions, indicating that the infection might have spread from the branch. No scabbed lesions or spore pustules were observed on the shoots before the experiments. Further investigations are in progress.

MARCHIONATTO (J. B.). **El 'corazon mohoso' de la Manzana. Nota preliminar.** ['Mouldy core' of the Apple. Preliminary note.]—*Rev. argent. Agron.*, v, 3, pp. 179–186, 2 pl., 1 fig., 1938.

A brief account is given of a condition of apples which an inspection at the beginning of 1938 showed to be fairly widespread in the orchards

of the upper valley of Rio Negro and Neuquen in the Argentine, and which is very similar to that described from the United States, Canada, New Zealand, and Australia under the names *Alternaria* rot, blossom-end rot, core mould, or mouldy core. Locally it was found to be apparently caused by a fungus which, by its morphological and biological characters, is identified as *Alternaria mali* [*R.A.M.*, x, pp. 227, 674]. Affected fruits, especially the highly susceptible Red Delicious variety, colour more rapidly than normal, and are often asymmetrical; they remain attached to the tree for a long time, falling only when the internal lesion is serious and involves the pulp. Evidence is adduced indicating that severe spring frosts are the main factor predisposing the fruit to infection, though the fungus may also be distributed by larvae of certain insects, e.g., *Bryobia praetiosa.* In the Argentine the disease was found on the varieties Delicious, Red Delicious, Gravenstein, Stayman, Winesap, and Jonathan, the two first-named varieties often showing 15 to 30 per cent. infection. The only method of control that has proved satisfactory is the prevention of frost damage by artificial heating of the orchards, but it is also recommended that affected fruits should be gathered immediately to prevent transmission of the infection to sound fruit. Cold storage of the harvested crop has been found to arrest the progress of the disease. [An abridged English version of this paper is published in *Int. Bull. Pl. Prot.*, xii, 9, pp. 189–191, 1938.]

GOLDSWORTHY (M. C.) & SMITH (M. A.). **The comparative importance of leaves and twigs as overwintering infection sources of the Pear leaf-blight pathogen, Fabraea maculata.**—*Phytopathology*, xxviii, 8, pp. 574–582, 1938.

Pear and quince leaf blight (*Fabraea maculata*) [*R.A.M.*, xvii, p. 188] is commonly present in the middle-western and eastern parts of the United States and has been reported from other parts of the country. The ascigerous stage has not been found on overwintered pear leaves in Maryland or Missouri; in these two States the conidia overwinter on diseased leaves and occasionally on bark cankers, but not on diseased fruits. Experimental evidence demonstrated that conidia overwintered on diseased leaves may cause spring infections, which are not, however, important sources of spread. In Maryland and Missouri the fungus overwinters mainly as mycelium in bark cankers. This forms acervuli late in winter, and in early spring conidia are produced, and escaping through cracks in the bark, infect the unfolding leaves; they are also washed downward through the tree, and set up cone-shaped tracts of infection in the leaves below the cankers. Conidia escaping from the leaf lesions may infect the young bark of the growing stems at any time during the growing season. The mycelium overwinters in some of these bark infections, the life-cycle of the organism being completed when conidia are produced on them in the following spring.

HILDEBRAND (E. M.) & PALMITER (D. H.). **X-virus disease of Peaches in New York.**—*Plant Dis. Reptr*, xxii, 13, p. 268, 1938. [Mimeographed.]

On 24th June, 1938, 'X disease' of peaches [*R.A.M.*, xvi, p. 21],

which has caused concern in Connecticut for five years, was identified in Columbia County, New York. In the infected orchard, out of the original planting of over 600 trees, about 120 remain, and of these 22·5 per cent. are diseased. A hedge containing affected chokecherries (*Prunus virginiana*) was present on two sides of the field. The affected peaches showed a heavy shedding of shot-hole leaves, progressing from the base towards the tips of the shoots, while the leaves remaining on the trees showed water-soaked to reddish spots and shot hole. Shaking the branches caused more leaves to drop. Similar symptoms but without leaf fall were shown by the affected chokecherries, on which also otherwise apparently normal leaves were turning yellow and red.

Moshkov [Moshkoff] (B. S.). **Photoperiodism and immunity.**—*C. R. Acad. Sci. U.R.S.S.*, N.S., xix, 9, pp. 751–754, 1 fig., 1 graph, 1938.

In experiments on photoperiodism the author observed variations in the degree of infection of the test plants by disease under the different conditions, particularly in the case of rose mildew [*Sphaerotheca pannosa*], gooseberry mildew [? *S. mors-uvae*], and cereals affected with brown rust [*Puccinia triticina*] and mildew [*Erysiphe graminis*]. In a study on the relationship between photoperiodic conditions and the development of infection of black-currant leaves by *Cronartium ribicola* [*R.A.M.*, xvii, p. 758], exposure of the leaves for periods of 10 to 17 hours each day resulted in different degrees of infection by the fungus. Leaves exposed for more than 17 hours remained perfectly clean, those given 17-, 16-, 15-, 14-, 13-, 12-, 11-, and 10-hour days showed 5, 10, 50, 75, 100, 40, 10, and 5 per cent. of the leaf surface affected, respectively, and those exposed for less than 9 hours a day remained uninjured throughout the whole season. This explains why under natural conditions in Leningrad the teleutospores of *C. ribicola* develop only in the autumn, when the day length is less than 16 hours. From these data the author concludes that immunity of plants from fungus parasites may depend upon the changes in the leaves induced by photoperiodic conditions.

Boresch (K.). **Über die Blattrandkrankheit der Johannisbeere mit einem Ausblick auf die Entstehung von Mangelchlorosen.** [On the marginal leaf scorch of Red Currant with reference to the development of deficiency chloroses.]—*Gartenbauwiss.*, xii, 2, pp. 176–233, 17 figs., 1 graph, 1938.

Almost complete control of marginal leaf scorch of red currants [*R.A.M.*, xvi, p. 545], a disease ascribed to potassium deficiency, was achieved in field experiments, carried out for six years on poor soils, when potassium sulphate, potassium nitrate, or dipotassium hydrogen phosphate was applied to the Dutch Red variety at a rate equivalent to 65 gm. potassium oxide per plant; the application of potassium chloride, on the other hand, produced severe symptoms of a very similar type of disease, attributed to excess of chlorine. The same amount of chlorine applied as ammonium chloride was not so harmful since ammonium salts favour the formation of chlorophyll, as is clearly seen from the deep green foliage of currant bushes treated with ammonium sulphate, an effect which was greater than that induced by

nitrates. In the absence of potassium, sodium chloride was the most harmful of the sodium salts, sodium nitrate less so, and sodium sulphate the least. In field experiments with the Kirsch currant variety the harmful effect of potassium chloride was successfully arrested by the addition of ammonium salts.

In pot experiments with the Dutch Red variety potassium deficiency was again successfully controlled by the addition of potassium sulphate, potassium nitrate, and even potassium chloride, provided the chlorine did not exceed 1·503 gm. per pot. Sodium chloride was beneficial when potassium was deficient, whereas ammonium and multivalent ions, especially magnesium, enhanced the effects of potassium deficiency. The addition of large quantities of chlorine was deleterious particularly in combination with sodium, less so with calcium, still less with ammonium, and least with magnesium. Excess of chlorine produced a chlorosis, developing from the margin towards the middle of the leaf with the formation of necrotic spots at a certain distance from the margin, and leading to a brown withering and premature death of the leaves. In general, the symptoms appeared at an earlier date and became more acute than those due to potassium deficiency and were controlled by the addition of ammonium nitrate.

Analyses of leaves of healthy and diseased currants showed that marginal leaf scorch appeared when the potassium content of the whole leaf sank slightly under 1 per cent. of the dry substance, and became more severe the further the percentage fell. It was seen from a comparison of healthy and recently diseased leaves that the chlorosis caused by chlorine develops only when chlorine ions are present in excess of potassium ions, and the author considers that there is a close ionic interrelationship between this condition and potassium deficiency. He argues that the direct cause of marginal leaf scorch cannot arise from a disturbance of the water balance of the leaf or a fixation of iron due to potassium deficiency, but that it must be sought, in accordance with the observations of K. Noak and Pirson, in the photo-oxidative destruction of chlorophyll associated with the disturbance of the normal assimilation process induced by the lack of potassium. It is possible that diseases of other plants caused by deficiency of potassium or other elements, such as iron or manganese, may be explained on a similar photodynamic basis.

WANN (F. B.) & RICHARDS (B. L.). **The effect of P_H on two Strawberry root rot fungi.**—*Proc. Utah Acad. Sci.*, xiv, pp. 45–46, 1937. [Abs. in *Exp. Sta. Rec.*, lxxix, p. 498, 1938.]

From the results of tests here briefly described it appears that the two strawberry root-rotting fungi, *Fusarium orthoceras* [*R.A.M.*, xvi, p. 822] and *F. solani*, may be partially controlled in Utah by the adjustment of the soil reaction to a P_H value corresponding to their minimum growth.

HIRAI (T.). **Diseases of the Banana in transport from Formosa.**—*Ann. phytopath. Soc. Japan*, viii, 2, pp. 145–165, 9 figs., 2 graphs, 1938. [Japanese, with English summary.]

Wastage in bananas in transport from Formosa is estimated to

amount to about 2 per cent. of the total of discharging cargoes, equivalent to 300,000 yen per annum [1 yen = 2*s*. 0½*d*. at par]. Diseases account for 87 per cent. of the wastage, of which 59 per cent. is non-infectious and 28 per cent. infectious.

The former group is represented in these studies by the conditions known as green-ripeness and 'kaze-hiki' due to excessively high and abnormally low temperatures, respectively, while the latter includes the following disorders: main stalk rot (comprising *Ceratostomella paradoxa* [*R.A.M.*, xv, p. 451], *Botryodiplodia theobromae* [loc. cit.], also associated with black rot, *Gloeosporium musarum* [loc. cit. and ibid., xvii, p. 50], likewise concerned in finger-dropping and anthracnose, and *Fusarium* spp.), sclerotial disease (*Corticium centrifugum*), black spot (*Macrophoma musae*), and grey mould (*Rhizopus nigricans*).

B. theobromae and *G. musarum* made scarcely any growth at 11° C., and *Ceratostomella paradoxa* developed scantily and slowly, so that the maintenance of this temperature in refrigerated transport appears to offer a promising means of combating the diseases under review.

White (R. P.). **Studies on the adhesiveness of sulfur residue on foliage.** —*Bull N.J. agric. Exp. Stas* 611, 21 pp., 18 graphs, 1936. [Received November, 1938.]

A tabulated account is given of the writer's studies at the New Jersey Agricultural Experiment Stations on the adhesiveness of sulphur residues on foliage, primarily with a view to the control of black spot [*Diplocarpon rosae*: *R.A.M.*, xvii, p. 821] and crown canker of roses [*Diaporthe umbrina*: ibid., xv, p. 722]. The following aspects of the problem were given special consideration: the influence of spray amendments (commonly known as 'spreaders' or 'stickers') on (*a*) the wetting properties of the spray fluid, (*b*) the original deposit of sulphur, (*c*) the mechanical loss and resulting residue, and (*d*) the rate of loss of the residue.

The data presented clearly indicate that the ability of sulphur suspensions to wet foliage is in general correlated with the surface tension of the continuous phase of the suspensoid, though with certain types of leaves, e.g., those of beet and snapdragon [*Antirrhinum majus*], exceptions to this rule occur, and various other discrepancies suggest that the chemical relationship between the leaf cuticle and the continuous phase of the suspensoid may also be involved.

The total deposit of the discontinuous phase of suspensoids of equal concentrations is dependent on the surface tension and the wetting capacities of the spray. Suspensoids with low surface tension or high wettability spread over the treated area in a thin film, and additional spray runs off, leaving a minimum of the discontinuous phase on the surface after drying. Conversely, suspensoids with high surface tension or low wettability may fail to wet the foliage at all, resulting in complete run-off and no deposit of the discontinuous phase. The sulphur suspensoids used in these tests had a variable surface tension. Amendment 2 (1 per cent. solution coco-nut fatty acid soap), which lowered the surface tension of water by 63·3 per cent. and wetted mature rose (Magna Charta) foliage with a thin film, consistently decreased the

amount of the original deposit of sulphur as compared with 13 (commercial wheat flour, 6 lb. per 50 gals.), which lowered the surface tension of water by only 14 per cent. and wetted rose leaves with a continuous thick film. Complete wetting of young rose foliage was ensured by the addition to the sulphur spray of the following amendments: (No. 1) 1 per cent. salt of a sulphonated carboxylic acid, (3) 1 per cent. of (1) plus over 50 per cent. inert diluent, (4) sodium lauryl sulphate, 1 in 1,000, (5) 1 per cent. sodium oleyl sulphate [ibid., xvii, p. 193], and (6) a mixture of resinous materials, 1 in 1,000, which reduced the surface tension of water by 65·9, 60·8, 52·2, 50·7, and 50·7 per cent., respectively.

A certain amount of the original deposit is mechanically lost with the first precipitation following drying of the spray. The greater the original deposit, the greater will be the total mechanical loss, due to the removal of the larger sulphur particles loosely attached to the leaf surface. With larger deposits, however, a greater number of colloidal particles will be deposited on the foliage, some of which will escape washing-off and remain available for protective purposes. The use of amendments with low surface tension, tending to decrease the original deposit, results in a run-off corresponding in part to the mechanical losses of heavier deposits. Following the initial mechanical loss, subsequent losses are independent of precipitation and directly correlated with time.

Lime-sulphur (1 in 49) deposited on rose foliage a larger amount of sulphur and retained more of it subsequent to mechanical loss than did flotation or precipitated sulphurs or a bentonite-sulphur. The original deposit of sulphur was further increased by the addition of a proprietary wettable sulphur. A greatly augmented deposit can be obtained with sulphur dusts but the mechanical losses are correspondingly increased, the residues after these have occurred approximating to those following the use of flotation-sulphur or a bentonite-sulphur mixture.

The type of foliage sprayed directly influences the original deposit and the residue, but appears to play little or no part in subsequent losses, which were equal in tests on peach, rose, and apple leaves.

Lawrence (W. J. C.) & Newell (J.). **Experiments on seed and potting composts. VI. A new method of steam sterilization.**—*Gdnrs' Chron.*, civ, 2696, p. 165, 1938.

A new, convenient and economical method of high-pressure steam sterilization of soil [*R.A.M.*, xvii, p. 475] for pot plants is described, in which, using steam at a pressure of 80 lb. per sq. in., 12 bush. of soil (over $\frac{1}{2}$ cu. yd.) spread 18 in. deep are heated to 212° F. in three or four minutes. The steam is then shut off, and the hot soil allowed to remain in the sterilizing bins for 20 to 25 minutes more, sterilization being completed by the residual heat of the soil. The loss of heat is relatively small if the soil is kept covered with sacking. This method reduces the amount of steam required by 80 per cent., allows a much smaller boiler to be used, and gives a much drier soil than does continuous steaming. If two or three bins are used large amounts of soil can be sterilized in one day with considerable economy and efficiency.

Handbuch der Pflanzenkrankheiten. Sechster Band. Pflanzenschutz. Verhütung und Bekämpfung der Pflanzenkrankheiten. [Handbook of plant diseases. Volume VI. Plant protection. Prevention and control of plant diseases.]—Lieferung 2, pp. 289–576, 61 figs., Berlin, P. Parey, 1938. RM. 16.60 (foreign countries RM. 12.45).

The present instalment of the sixth revised edition of Sorauer's 'Handbook of Plant Diseases', issued under the general supervision of Dr. O. Appel [*R.A.M.*, xvi, p. 478], contains the conclusion of W. Trappmann's section on physical methods of control and valuable, comprehensive contributions on chemical (inorganic and organic) plant-protectives by W. Trappmann, G. Hilgendorff, A. Winkelmann, W. Fischer, and W. Tomaszewski; the biological testing of plant- and foodstuff-protectives by A. Winkelmann and H. Klinger; and physical and chemical methods of testing by G. Hilgendorff and W. Fischer (incomplete).

REED (H. S.). **Cytology of leaves affected with little-leaf.**—*Amer. J. Bot.*, xxv, 3, pp. 174–186, 17 figs., 1938.

The author investigated the cytological conditions of leaves of apricot, peach, tomato, maize, squash, mustard, and buckwheat affected with little leaf [*R.A.M.*, xvi, p. 682; and above, p. 36]. In comparison with healthy leaves the cells of the palisade parenchyma of affected leaves were larger but less numerous, and in the tomato there was marked atrophy of the mesophyll. The cell structure of affected leaves of certain plants exhibited a lack of differentiation resulting in an essentially juvenile or, perhaps, xerophytic type of leaf. The disease is characterized by destruction of the chloroplasts or by inhibition of their development, the cells receiving most illumination showing the greatest plastid injury. Hypoplastic conditions were often associated with agglutination of the plastids, which became vacuolated and shrunken, and, except in the peach, usually devoid of starch. The factors producing this derangement appear to be quite localized since adjacent cells may show none of these symptoms. Lytic factors associated with the disease frequently destroyed most of the cell contents in more or less extensive areas. Phenolic substances were present in affected, especially acutely affected, leaves of some plants (e.g., apricot) but not of others (e.g., maize) and were also present in old healthy leaves of certain plants. The endodermal cells of affected apricot and peach leaves were replete with phenolic substances, which showed, however, little tendency to diffuse, and in the case of senescent peach and apricot leaves plant gums were present. Species showing leaves dwarfed by the disease contained more tannin.

Zinc salts may possibly act by catalysing the oxidation processes and in their absence biochemical reactions may proceed in the reverse direction. Tannin may also impede oxidation and these two factors may account for much of the derangement of the leaf cells. The fibrovascular system of affected leaves showed on the whole fewer derangements than the cells of the palisade and mesophyll layers and it is concluded, therefore, that the disease is associated with metabolism rather than with conduction.

PROCTOR (B. E.) & PARKER (B. W.). **Microbiology of the upper air. III. An improved apparatus and technique for upper air investigations.**—*J. Bact.*, xxxvi, 2, pp. 175–184, 2 pl., 1938.

Full technical details are given of an improved apparatus, termed a 'bioaercollector', for the collection of micro-organisms from the upper air, which has been successfully used in 40 aeroplane flights over greater Boston (Massachusetts) from November, 1936, to June, 1937, when the following moulds were obtained at altitudes between 1,500 and 16,500 ft. [cf. *R.A.M.*, xv, p. 167]: *Aspergillus niger*, *A. glaucus*, *A. flavus*, *A. calyptratus*, *Macrosporium* sp., *Penicillium frequentans*, *Cladosporium* sp., *Hormodendrum* [*C.*] *herbarum*, *P. glabrum*, and *P. lanosum*.

HENDERSON SMITH (J.), ANDREWES (C. H.), BAWDEN (F. C.), BERNAL (J.), MCFARLANE (A. S.), & GARROD (L. P.). **Discussion on recent work on heavy proteins in virus infection and its bearing on the nature of viruses.**—*Proc. R. Soc. Med.*, xxxi, 3, pp. 199–210, 1938.

This is an interesting critical and analytical discussion of the recent work by Stanley, Wyckoff, and others on heavy proteins in relation to virus (especially tobacco mosaic) infection, and on the application of the resultant data to the problem of the nature of viruses [*R.A.M.*, xvii, p. 761]. The writers' conclusions may be briefly summed up as follows. J. Henderson Smith thinks all the evidence to date is in favour of the view that the protein is the actual virus, since any procedure that removes the protein lowers infectivity, the activity of the virus is destroyed by the same temperature or degree of acidity or alkalinity as the protein, the hypothetical virus contaminant must have the same isoelectric point and molecular weight as the protein, and in short there is no means of dissociating one from the other.

C. H. Andrewes considers it obvious that the viruses possess certain properties hitherto associated with autonomous living entities and others formerly regarded as inherent in non-living chemical substances. This does not, however, necessarily imply a transition from the non-living to the living, a more plausible view being that the viruses are micro-organisms which have gradually declined in size and lost (to their own advantage) some of the chemical complexities of larger beings and at the same time become subject to physico-chemical laws entailing such processes as the formation of paracrystals. The fact that the viruses can, under certain conditions, arrange themselves in regular rows like other heavy proteins does not, in the writer's opinion, counterbalance such evidence of life as is afforded, e.g., by their immunological properties, resembling those of bacteria, their capacity to form haptenes or multiply in an insect intermediate host, their adaptability to altered conditions, and their graded series of sizes, larger in some instances than cultivable organisms.

F. C. Bawden gives a résumé of his reasons for believing that the nucleoproteins isolated from tobacco mosaic, tomato enation and aucuba mosaics, cucumber viruses 3 and 4, and potato virus X [ibid., xvii, p. 764] are the viruses themselves.

J. D. Bernal's optical and X-ray investigation of Bawden's preparations of tobacco mosaic and the cucumber and potato X viruses

shows that all contain long particles, accounting for the double refraction of flow [see below, p. 61] of the dilute solution, the spontaneous double refraction of the more concentrated solution, and the formation of double refracting gels and spindle-shaped tactoid bodies. Stanley's 'crystals' are in all probability really microtactoids, indistinguishable from 'wet gel', containing about 50 per cent. water, formed by drying the concentrated solution. Traditional views as to the vital nature of the viruses would seem to be definitely contradicted by the evidence of large-angle scattering, corresponding to the arrangement of a semi-crystallized protein, obtained by X-ray photography of the virus preparations, which shows unequivocally the occurrence of perfect three-dimensional regularity within the particles, persisting unchanged from the driest gel to the most dilute solution. The scale of this regularity (of the order of 20 Å.) is much smaller than any particle hitherto claimed to represent a living organism, and is intermediate in character between that observed in undenatured and denatured proteins.

A. S. McFarlane points out that one particle or molecule of tobacco mosaic protein consists of a number of units (amino-acids or polypeptide chains), in the fixed mutual relationship of a crystal lattice. Crystallographic measurements reveal a virtual absence of water within each particle, while centrifugal calculations point to a close similarity in the size of the molecules, features tending strongly to disprove one of the main arguments for the organic nature of these structures, i.e., the manifestation by the particles in contact with the living plant of infectivity and proliferative capacity.

L. P. Garrod thought one of the arguments adduced by C. H. Andrewes in favour of the living nature of viruses could be refuted, namely the production of immunity by virus infections. Non-living substances could excite specific antibody formation, and it was not difficult to picture a precipitin-like action as the basis of acquired immunity from virus diseases.

Bojanovsky (R.). **Absolute Reinkulturen von Pilzen aus Speziesreinkulturen durch Ionenzuchtwahl (phyletisches Ionenphänomenon).** [Absolutely pure cultures of fungi from specifically pure cultures by means of selective effect of ions (phyletic ion-phenomenon).]—*Zbl. Bakt.*, Abt. 2, lxxxxix, 1–4, pp. 55–60, 2 graphs, 1938.

The author states that by using nutrient media containing 4·86 per cent. potassium thiocyanate (0·5 mol concentration) he succeeded in freeing cultures of a cellulose-destroying fungus isolated from soil, from contaminating bacteria. He also demonstrated the possibility of suppressing the growth of bacteria, artificially introduced into pure cultures of *Aspergillus niger*, by the addition to the substratum of aluminium sulphate up to a concentration of 0·03 mol.

Young (J. E.). **Exposure of fungus organisms to ultraviolet rays.**—*Proc. Ind. Acad. Sci.*, xlvii, pp. 93–95, 1938.

Cultures of *Sclerotium rolfsii* and *Macrosporium* [*Alternaria*] *solani* on potato dextrose agar were exposed to ultra-violet irradiation by a Hanover quartz-mercury arc vapour lamp at a distance of 25 cm.

[see next abstract]. The initial effect of the rays was a retardation of growth, *S. rolfsii* being particularly sensitive. After ten hours, however, more than normally vigorous growth was resumed, characterized by aerial mycelium arising from profuse branching of swollen hyphal tips. This effect is tentatively attributed to the accumulation in the bulbous tips of growth-promoting hormones.

GIER (L. J.). **Effects of ultrashort radio waves and ultraviolet light on microörganisms.**—*Trans. Kans. Acad. Sci.*, xl, pp. 55–57, 1938.

Cultures of *Bacterium vesicatorium* [*R.A.M.*, xvi, p. 655], *Actinomyces scabies*, *Saccharomyces* spp., *Alternaria solani* [see preceding abstract], *Cephalosporium* sp., *Diplodia zeae*, and *Gibberella saubinetii* on potato dextrose agar were incubated for 24 hours at room temperature and then exposed in an aluminium irradiation chamber with bakelite spacers to wave-lengths of 27 to 45 cm. for periods ranging from 4 to 217 hours.

Bact. vesicatorium was killed in all cultures except one at 35 cm. after exposure for 24 hours and upwards. Exposures up to 49 hours at 45 cm. produced no effect on *Actinomyces scabies*, while *S.* spp. (on nutrient and potato dextrose agars) showed no difference after 120 hours at 35 and 45 cm. At 45 cm. *Alternaria solani* and *C.* sp. became slightly stunted after more than 72 and 48 hours, respectively. A faint bleaching of *D. zeae* was apparent after 120 to 217 hours at 35 cm. *G. saubinetii* displayed much sectoring after 48 hours at 29 cm., and was smaller and paler after the same period at 37 cm.

Concurrently with the ultra-short wave experiments, cultures of *A. solani*, *G. saubinetii*, and three strains of *F. moniliforme* [*G. fujikuroi*] were exposed to a General Electric mercury vapour lamp of the Hanover type without filters, suspended at a height of 28 cm. above the centres of the culture dishes. Notwithstanding precautions against excessive heating of the cultures the temperature rose to a maximum of 68° C. after an hour of treatment. Cultures of *A. solani* exposed for 5 and 10 minutes showed exceptionally profuse sectoring, while longer treatments resulted in severe stunting or killing. After 10 minutes' exposure, spores of the fungus in a hanging drop of sterile tap water germinated as well as similar non-irradiated cultures, but after 24 hours all growth had ceased in the former while proceeding normally in the latter. *G. saubinetii* and *G. fujikuroi* responded to the treatment by a darkening of colour from pale cream to purple-black, but sectoring occurred only in one strain of the latter exposed for 20 minutes on each of three successive days.

The writer concludes from these experiments that plant diseases may possibly respond to radio wave treatment, but since the requisite wave-length probably varies with each organism, considerable experimental work would be necessary to ensure successful results. The effects of unfiltered violet light may be largely or entirely due to heat.

VAN LUIJK (A.). **Antagonism between various microorganisms and different species of the genus Pythium, parasitizing upon Grasses and Lucerne.**—*Meded. phytopath. Lab. Scholten*, xiv, pp. 43–82, 6 pl., 1938.

These studies on the antagonism between various micro-organisms

and *Pythium volutum*, *P. de Baryanum*, *P. intermedium*, *P. irregulare*, and *P. mamillatum* were made in series of experiments *in vitro* and in pots; all these species were parasitic on *Lolium annuum* var. *westerwoldicum*, *Festuca duriuscula*, and *Agrostis stolonifera* [cf. *R.A.M.*, xiv, p. 240], and *P. de Baryanum* was also parasitic on lucerne. The antagonistic organisms, separately or in combination, were tested with the parasite and host together or the parasite alone in culture.

In pot inoculation experiments with *P. volutum* on *A. stolonifera* the infection was much stronger in sterile than in non-sterile soil, the presence of the parasite reducing the average dry weight of the plants per pot, measured at the end of the experiment, from 17·31 to 3·96 gm. in the sterile, and from 9·68 to 6·57 gm. in the non-sterile soil. This result is ascribed to the influence of the antagonists present in the non-sterilized soil. *P. volutum* and *P. de Baryanum* proved to be the most virulent of the parasites tested. In experiments with *P. volutum* and several unspecified parasites and saprophytes on *F. duriuscula* it was found that parasites may be even stronger antagonists than saprophytes. The substances inhibiting the growth of *P. de Baryanum* were studied by adding filtrates prepared from one-month-old cultures of *Pullularia pullulans* to the cultures of *Pythium de Baryanum*. It appeared that the filtrates from cultures of *Pullularia pullulans* grown at 4° to 15° C. inhibited development considerably, but those grown at 14° to 21° hardly at all. The growth-inhibiting substances were neutralized when exposed to a temperature of 100°. When *Pullularia* cells were separated from their metabolic products by filtering, and a suspension of these cells in Knop saccharose was heated in boiled water, diluted to various strengths, and inoculated with *Pythium de Baryanum*, stimulation of growth occurred in almost every case. From these results the author concludes that the growth-inhibiting substances formed by *Pullularia pullulans* are thermolabile and are present in the filtrate, while substances stimulating growth are thermostable and are probably chiefly present in the cells.

In experiments with pots and large glass tubes under non-sterile conditions in the open air, filtrates of *P. pullulans* showed no antagonistic effect, but the presence of *Pullularia* cultures almost completely prevented the infection of *L. annuum* var. *westerwoldicum* with *Pythium de Baryanum*, the average dry weight of grass per tube in the control being 1,650 mg., in the tubes inoculated with *P. de Baryanum* 760 mg., and in tubes inoculated with *P. de Baryanum* and *Pullularia pullulans* 1,637 mg. *Pythium* spp. may also be mutually antagonistic under non-sterile conditions.

Experiments were then carried out with various fungi isolated from soil suspensions and added to tubes containing *A. stolonifera* inoculated with *P. volutum*. After 22 days the control tubes yielded 88 healthy plants (from 100 seeds), those inoculated with *P. volutum* only 19, and those inoculated with *P. volutum* plus a sterile mycelium or *Verticillium cinnabarinum* [*Acrostalagmus cinnabarinus*] 59 and 45, respectively. Stimulation of the germination of *F. duriuscula* followed the addition of a *Mucor* to the culture tubes.

In another series of experiments the liquid filtrates from cultures of a wide range of organisms were sterilized at 102° for 5 minutes and

inoculated with *P. de Baryanum*. The growth of the fungus up the tubes after 4 days was 50 or 51 mm. in the controls whilst that in filtrates of *V. cinerescens* [ibid., xvi, p. 726], *A. cinnabarinus*, *P. irregulare*, and *P. mamillatum* reached 0, 17, 36, and 53 mm., respectively. In further experiments it appeared that *Penicillium expansum* was the strongest antagonist of *Pythium de Baryanum* and one strain of it, 18a, inhibited the growth of *P. de Baryanum* in dilutions up to 1 : 128 [ibid., xvii, p. 617]. When a number of carbon sources were used in synthetic liquid media on which strain 18a was grown, the mono- and disaccharides (with the exception of lactose) provided media with the greatest inhibitive effect on the growth of *Pythium de Baryanum*, the polysaccharides being decidedly weaker. From these results it is concluded that the inhibiting substances are metabolic products of carbon compounds.

In discussing the possibilities of combating plant diseases by antagonistic organisms the author states that the formation of toxins by the latter in soil will largely depend on the environmental factors. The application of filtered or sterilized cultures or even of inhibiting substances isolated from them is therefore thought to promise better results. The advantage over organic disinfectants lies in the fact that the metabolic products of *Penicillium expansum* may be applied to either artificially inoculated or infected, non-sterilized soil a few days before sowing without damaging the seedlings.

SEMPIO (C.). **Primo contributo alla conoscenza dell' azione esercitata da vari fattori ambientali su alcune malattie parassitarie di piante coltivate ('ruggine del Fagiolo').** [First contribution to the knowledge of the action exerted by various environmental factors on some parasitic diseases of cultivated plants (Bean rust).]—*Riv. Pat. veg.*, xxviii, 7–8, pp. 241–351, 11 figs., 17 graphs, 1938.

A full account is given of experiments carried out to determine the effect of various environmental factors on the host-parasite relationships between Cinquantino giallo beans and *Uromyces appendiculatus* [cf. *R.A.M.*, xvi, p. 49]. The inoculated plants were placed under bell jars during the following periods, viz., from the first to the third or fourth day after (and including) the day of inoculation, from the third or fourth to the sixth day, and from the seventh to the ninth or tenth day. A further series was incubated for the whole period, and two lots of controls were kept under bell jars for the first 48 hours and for the whole period, respectively. The optimum temperature for the development of the rust was found to be 19° to 20° C. and between 14° and 24° no differences could be observed in the behaviour of the rust on the plants incubated for these different periods.

At temperatures from 26° to 28° plants incubated for the third period showed the greatest susceptibility to infection and this period would appear to be a critical one for the disease. When, however, the same plants were kept for a further six or seven days at 15° to 20° the leaves regained their normal colour. The evidence showed that for plants exposed to temperatures of about 27° during the third period the susceptibility to infection of the tissues farthest away from the infection centres and not directly invaded was increased, while the invaded tissues tended to lose their susceptibility. Temperatures of

34° to 36° completely sterilized well-developed mycelium present in the leaves in $2\frac{1}{2}$ days, without appreciable injury to the plant tissues, when the treatment was applied four days after inoculation, though plants in which the mycelium was so sterilized on two consecutive occasions were not immune from further attack.

When inoculated plants were immediately exposed to carbon dioxide at concentrations of 8·28 and 9·66 per cent., the gas markedly retarded infection in all three periods of incubation, while the resistance of the fungus to the toxic effect of the gas increased progressively from the first to the third period, the strong toxic effect of the gas in the first period being due to its direct action in inhibiting germination. In another series of experiments, in which plants in the first period were exposed to concentrations of 7 to 9·5 per cent. of the gas 18 hours after inoculation, the second stage was much more susceptible to the action of the gas than the first or the third. The author considers that the gas affects the metabolism of the plant rather than the fungus itself.

Absence of light did not adversely affect the disease during the first period, but retarded it during the third. Red, yellow, and green light (applied through colour screens) had no appreciable effect, but blue light definitely reduced infection.

When the plants were exposed daily for progressively increasing periods (totalling 28 to 30 minutes) to ultra-violet radiation, in all three periods of infection, the upper, irradiated leaf surfaces showed no, or very few, pustules, while the surfaces not directly exposed developed a normal number of pustules, and the leaves screened from the rays showed the same amount of infection as the controls.

During the 20 to 24 hours after inoculation, a high degree of relative humidity was necessary for infection to develop rapidly. At other times, especially in the third period, the disease made most progress at relative humidities of about 70 per cent.

It is concluded that, on the whole, the third period of infection is the most critical. In the first period the plant is usually more resistant to unfavourable environmental factors than during the other periods.

AJROLDI (R.). **Influenza di micromiceti sulla germinazione e sullo sviluppo di piante ortensi.** [The influence of micromycetes on the germination and development of horticultural plants.]—*Ital. agric.*, lxxv, 8, pp. 519–587, 5 figs., 1938.

Neither culture filtrates nor mycelial extracts of *Fusarium bulbigenum* var. *lycopersici* and *Alternaria brassicae* exerted any significantly adverse effects on the germinative capacity and energy of tomato and cabbage seed, respectively, in experiments at the Institute of Plant Pathology, Milan University. On the other hand, they produced chlorosis, feeble stem growth, stunting of the aerial organs, atrophy of the piliferous zone, and necrosis of the root tissues in seedlings when brought into direct contact with the root systems. The injurious influence of the filtrates increased *pari passu* with the age of the cultures, whereas the mycelial extracts were most active in the early stages of development. It would appear from these observations that the toxic action of *F. bulbigenum* var. *lycopersici* and *A. brassicae* on their respective hosts is primarily of a chemical nature, being associated

with the metabolic changes induced by the fungi in the various constituents of the substratum.

GARRARD (E. H.) & LOCHHEAD (A. G.). **Relationships between soil micro-organisms and soil-borne pathogens. A review.**—*Sci. Agric.*, xviii, 12, pp. 719–737, 1938.

This is a full review of the present state of knowledge of the possible relationships of soil saprophytes to soil-borne organisms producing disease in plants, the points dealt with including root rot investigations, inhibitive action of species of *Trichoderma* [*R.A.M.*, xvi, p. 268 *et passim*], the action of protozoa, the mechanism of antagonism, toxins, lysis, enzymes, staling, soil acidity, and 'growth factor'. A bibliography of 100 titles is appended.

KÖHLER (E.). **Die wichtigsten Kartoffelkrankheiten und ihre Bekämpfung.** [The most important Potato diseases and their control.]—*Arb. Reichsnährst.* 44, 64 pp., 1 col. pl., 28 figs., 3 maps, 1938.

In addition to a number of well-known fungal, bacterial, insect, and physiological disorders affecting the potato crop in Germany, the writer gives a popular account of the following viruses involved in the etiology of 'degeneration': mild mosaic (caused by virus X), a mosaic attributed to virus A (which in combination with X can also cause streak or crinkle), streak (Y), leaf roll of two types, viz., leaf roll proper, carried by *Myzus persicae*, and leaf-rolling mosaic (Z) [*R.A.M.*, xv, p. 460], not transmissible by this aphid, and stunting. Notes are also included on 'Eisenfleckigkeit' and 'Pfropfenbildung' [spraing: ibid., xiii, p. 650; xvii, p. 410]. Control measures are concisely indicated.

GARBOWSKI (L.). **Choroby wirusowe Ziemniaków.** [Virus diseases of Potatoes.]—98 pp., 6 col. pl., Bydgoszcz, Wyd. państw. Inst. Nauk. Gosp. wiejsk. w Puławach, 1938.

In part I of this booklet on the virus diseases of potatoes the present status of knowledge on the physical, chemical, and biological properties of viruses in general is discussed; part II, dealing only with potato viruses, is planned on the lines of the corresponding chapter from the 'Text-book of plant virus diseases' by K. M. Smith [*R.A.M.*, xvii, p. 52], whose system of classification is adopted; and in part III, the practical aspects of the diagnosis of virus diseases, the preparation of healthy seed material, and the breeding of resistant varieties are presented. A disease resembling spindle tuber has been observed in Poland [cf. ibid., vi, p. 572], but the author states that it is uncertain whether the disorder is due to a virus or to physiological causes.

DYKSTRA (T. P.) & WHITAKER (W. C.). **Experiments on the transmission of Potato viruses by vectors.**—*J. agric. Res.*, lvii, 5, pp. 319–334, 5 figs., 1938.

Details are given of experiments from 1932 to 1934 in Oregon, in which the transmission was studied under muslin-covered cages in the field of potato virus diseases by four species of aphids (*Myzus persicae* [*R.A.M.*, xvii, pp. 763, 834], *M. circumflexus*, *M. pseudosolani*, and *Macrosiphum solanifolii*) and some other insects. The results showed

that all the aphids tested can serve as vectors of leaf roll, rugose mosaic, crinkle mosaic, and mild mosaic. With the exception of leaf roll, a much higher percentage of transmission of the viruses occurred when the aphids had continuous access both to diseased and healthy plants than when they were transferred directly from the former to the latter, suggesting that the mosaic viruses may retain their virulence inside the aphids only for a short time. Direct transference of the three *Myzus* species from leaf roll to healthy plants usually resulted in a high percentage of transmission of the disease, but *Macrosiphum solanifolii* generally failed to transmit it by this method, although this species was occasionally able to transmit a fairly high percentage of leaf roll. In many cases the three *Myzus* species, when transferred from plants infected with a combination of leaf roll and one of the potato mosaics, failed to transmit the latter. The fact that, while the *Myzus* species at times transmitted different potato viruses, they often failed to transmit the same viruses under apparently similar conditions, suggests that the reason may be physiological, and that perhaps such factors as light, temperature, or humidity may influence the virus within the aphid. Since in practically all the cases observed these three species fed consistently in the phloem region of the plants, it appears that the variation in results cannot be explained by their feeding habits. Mild and crinkle mosaics were transmitted from potato to tobacco by *Myzus circumflexus*, *M. pseudosolani*, and *Macrosiphum solanifolii*, although in many cases the results were negative. As few as five aphids per plant were sufficient to cause infection.

All the other insects naturally feeding on the potato, namely, *Lygus pratensis*, *Epitrix subcrinata*, *Empoasca filamenta*, *Philaenus leucophthalmus*, and *Nabis alternatus*, failed to show any transmission of the potato viruses studied.

OLDAKER (C. E. W.). **Blight (Phytophthora infestans) of Potatoes in Tasmania.**—*Tasm. J. Agric.*, N.S., ix, 3, pp. 134–137, 1938.

The author briefly reviews the history of potato blight (*Phytophthora infestans*) in Tasmania from its first appearance in 1906 until the present time [*R.A.M.*, xi, p. 322]. Infection increased in scope and intensity in 1908, and in 1910, in spite of vigorous spraying, heavy losses were sustained. In 1911, the disease swept the country, and the Red Skin variety, mainly grown until that date, was replaced by a new resistant variety of unknown origin, Brownell; the spring and summer of 1914 and 1915 were dry and sunny, and for the next ten years, although spraying was gradually dropped, the disease virtually disappeared, except in the north-west, where a susceptible variety was still grown. In 1926–7 the principal early variety, Bismarck, became affected in some localities. Since then, sporadic outbreaks have occurred from time to time, but infection has not been serious enough to arouse more than local concern. In some districts, heavy losses (50 to 60 per cent. or even more on Bismarck) have been incurred during the current year. An increase in yield of 30 per cent. resulted in one instance after three spray applications at intervals of three weeks during the infective stage.

GOSS (R. W.) & AFANASIEV (M. M.). **Influence of crop rotations under irrigation on Potato scab, Rhizoctonia, and Fusarium wilt.**—*Bull. Neb. agric. Exp. Sta.* 317, 18 pp., 5 graphs, 1938.

Most of the results so far obtained in the course of observations in Nebraska, initiated in 1912, on the influence of crop rotation on the incidence of potato scab [*Actinomyces scabies*], *Rhizoctonia* [*Corticium solani*], and *Fusarium* wilt [*F. oxysporum* and *F. solani* var. *eumartii*] have already been summarized from another source [*R.A.M.*, xvi, p. 488]. Although the effect of some of the crop sequences varied with different diseases, the rotations resulting in the least infection were the same for all three diseases, and also produced the best yields. The best results were obtained with four- and six-year rotations with lucerne preceding the potato crop, and the least satisfactory as regards both disease and yield were obtained from maize and potato rotations or continuous culture of potatoes. In short rotations the addition of farmyard manure increased the amount of scab, but reduced the amount of *Rhizoctonia* and doubled the yield.

WALKER (J. C.), LARSON (R. H.), & ALBERT (A. R.). **Studies of resistance to Potato scab in Wisconsin.**—*Amer. Potato J.*, xv, 9, pp. 246–252, 1938.

Tabulated data are presented and discussed showing the marked influence of the environmental complex on varietal reaction to potato scab (*Actinomyces scabies*) [*R.A.M.*, xvii, p. 199 *et passim*] in three localities of Wisconsin in three consecutive seasons (1935 to 1937). Thus, in 1935 Early Ohio and Beauty of Hebron were significantly less scabby than three other early varieties tested, whereas in the following year this difference did not hold good either in the silt loam soil of Antigo or in a scab-infested muck soil near Delavan. In the late maturing group the range of infection at Antigo in 1935 accorded with the commonly accepted commercial rating of the varieties on trial, Green Mountain and Chippewa being very susceptible, Russet Burbank highly resistant, and Rural New Yorker and Russet Rural intermediate. In 1936 the greater severity of the disease in the same locality practically removed the significance of any varietal differences, though Chippewa retained the maximum scab incidence (Green Mountain was not tested in this season) and Russet Burbank the lowest. At Arnott (sandy loam), where the disease assumed only a moderate form in 1936, the same general varietal order was observed as at Antigo in 1935. At Delavan in 1937 two Russet Rural strains were appreciably more resistant than two Rural New Yorkers. Of the non-commercial varieties tested in 1937, Lady Llewellyn and Hindenburg × Centifolia 15 were outstandingly free from scab, Wee McGregor and Vick's Early about equally susceptible with Green Mountain and Irish Cobbler, and Sutton's Reliance, Early Rose, Gold Nugget, Brown Beauty, and Golden intermediate. White-Blossomed Cobbler and Earlaine were substantially less affected than Irish Cobbler.

METZGER (C. H.). **A new Potato disease in Colorado.**—*Amer. Potato J.*, xv, 8, pp. 225–230, 1938.

A potato disease believed to be bacterial wilt (*Bacterium solana-*

cearum) [*R.A.M.*, xvii, p. 700] made its appearance in 1937 in Colorado, where the Bliss Triumph variety contracts more extensive tuber rot from this cause than Irish Cobbler. Combined aerial and tuber symptoms were observed on Rural New Yorker, while the tubers of Brown Beauty, Red McClure, Russet Burbank, and Katahdin were also affected. It is thought that unduly late cultivation or hilling may have contributed to the spread of the disease through extensive root injury.

Burkholder (W. H.). **The occurrence in the United States of the tuber ring rot and wilt of the Potato (Phytomonas sepedonica—(Spieckermann u. Kotthoff) Bergey et al.).**—*Amer. Potato J.*, xv, 9, pp. 243–245, 1938.

The organism isolated from a yellowish rot of cheesy consistency in the vascular area of potato tubers from Maine in January, 1938, was a Gram-positive, non-motile rod, 1·25 by 0·72 μ, forming on a special medium of 1 l. potato broth, 5 gm. peptone, 2 gm. each of sodium phosphate and sodium chloride, 1 gm. sodium citrate, 6 gm. each of asparagin and dextrose, and 12 gm. agar, cream-coloured, wet, glistening, somewhat sticky colonies, not liquefying gelatine, producing a little hydrogen sulphide, slightly hydrolysing starch, and reducing but not clearing litmus milk: it is identified as *Bacterium sepedonicum* [*R.A.M.*, xvii, p. 586]. Inoculation experiments on Green Mountain potatoes gave positive results, the causal organism being reisolated from the diseased material.

Hill (L. M.) & Orton (C. R.). **Microchemical studies of Potato tubers affected with blue stem disease.**—*J. agric. Res.*, lvii, 5, pp. 387–392, 7 pl., 1938.

An account is given of comparative microchemical studies of healthy Russet Rural potato tubers and of tubers of the same variety affected with the disease recently described by the authors from West Virginia and since become known as blue stem [*R.A.M.*, xvii, p. 552] because of the characteristic discoloration of the stems during the later stages of the disease. It was found that in the necrotic regions of the phloem and parenchyma, the cellulose and pectic cell walls were partially masked by a deposit of suberin, on the removal of which with an oxidizing solvent the cellulose walls remained intact. Tests for cellulose and lignin in necrotic xylem gave positive results. A suberin-like substance present in necrotic phloem, parenchyma, and xylem was soluble in Schultze's reagent and gave a positive test for cerin. In the necrotic regions and 'zones' (areas of definite extent around the necrotic regions) the starch grains were partially or totally dissolved, and were replaced by a higher concentration of glucose, the sucrose content remaining unchanged; protein, tyrosin, and solanin were absent; and fat was uniformly distributed throughout the healthy tubers and in the zones of the diseased tubers, but none was found in the necrotic areas. Nitrates were absent from the necrotic areas and the zones, while iron and oxidase were concentrated in the latter, and phenol was detected in the cell walls of the necrotic areas. Calcium, potassium, and magnesium, phosphates, chlorides, and sulphates were determined in very small quantities in both healthy and diseased tubers.

ELISEI (F. G.). **Primo reperto in Italia del Fusarium moniliforme Sheld. parassita del Riso (Oryza sativa L.).** [First discovery in Italy of *Fusarium moniliforme* Sheld., a parasite of Rice (*Oryza sativa* L.).]—Reprinted from *Atti Ist. bot. Univ. Pavia*, Ser. IV, xi, 12 pp., 7 figs., 1938. [Latin summary.]

In August, 1938, the author received from Novara adult rice plants of the Giovanni Roncarolo variety which showed yellowing of the stem and leaves due to *Fusarium moniliforme* (*Gibberella fujikuroi*) [*R.A.M.*, xvii, p. 769]. This is stated to be the first record of a rice disease resembling 'bakanae' in Italy.

WAKSMAN (S. A.). **Humus: origin, chemical composition, and importance in nature. Second edition.**—xiv+526 pp., 4 figs., 40 graphs, London, Baillière, Tindall & Cox, 1938. 30*s*.

New features of this revised edition of the author's treatise [cf. *R.A.M.*, xv, p. 526] include references to the extensive Russian literature on the subject and the addition of further information on the relation of organic matter to soil conservation.

SCHROPP (W.). **Beiträge zur Kenntnis der Kalimangelerscheinungen bei einigen Öl- und Gespinstpflanzen.** [Contributions to the knowledge of potash deficiency symptoms in some oil- and fibre-yielding plants.]—*Ernähr. Pfl.*, xxxiv, 10, pp. 165–170; 11–12, pp. 181–186, 14 figs., 1938. [English and Spanish summaries on pp. 180, 204.]

Particulars are given of the author's laboratory and field observations and experiments at the Institute of Agricultural Chemistry, Weihenstephan, Bavaria, on the symptoms of potash deficiency in certain oil- and fibre-yielding plants grown on various types of soil. In colza and rape the shortage induced marked retardation of shoot growth, poor leaf development, and foliar malformation and discoloration. Potash-deficient poppies [*Papaver officinale*] were characterized by a darkening of the leaf colour, belated flowering, and general stunting of the plants. White mustard [*Brassica alba*] plants receiving no potash developed thick, squat stalks, inward curling of the leaf margins, and brown spotting of the leaf surfaces. Similar features were typical of *Camelina sativa* and oil radish (*Raphanus oleiferus*) deprived of the necessary potash supply. Soy-beans also reacted to the absence of the essential nutrient by brown spotting of the foliage and inward curling of the margins, the young leaves in addition displaying an abnormally dark discoloration. The potash requirements of castor oil (*Ricinus communis*) being exceptionally high, a shortage of this element results in arrest of growth, reduction in leaf size, foliar discoloration, and inward curling of the margins. Flax, hemp, and jute plants receiving an inadequate potash supply all produce abnormally dark-coloured foliage; in the first-named the tips of the lower leaves later turn brown, branching is excessive and flowering delayed, while in the case of hemp the leaves present a convex appearance similar to that of a watch glass and the margins become brown.

Varadaraja Iyengar (A. V.). **Contributions to the study of spike disease in Sandal (Santalum album, Linn.). Part XIX. Physiological and physical methods of characterising the disease.**—*J. Indian Inst. Sci.*, xxi a, 8, pp. 89–101, 5 figs., 1 graph, 1938.

Healthy sandal (*Santalum album*) plants growing under adverse conditions were observed in several localities in India to produce small, narrow leaves resembling those affected by spike disease [*R.A.M.*, xvii, p. 626]. An attempt was made, therefore, to evolve a simple and reliable method for the identification of the disease. The methods previously used, e.g., the transmission of infection by grafting, or the recognition of X-bodies in spiked leaves, are too lengthy and complicated for immediate diagnosis in the field, while the microscopic examination of spiked leaves for the presence of excessive starch is quite misleading, since the starch content was found to be influenced by environmental conditions. The author compared the calcium: nitrogen ratio in normal and spiked sandal leaves from five different localities, examining 12 trees in each case, and found that it was consistently lower in the spiked leaves, the figures for healthy leaves and those showing advanced spike being 1·32 and 0·29, 1·01 and 0·35, 0·96 and 0·31, 0·94 and 0·28, and 1·28 and 0·27, respectively. These results were confirmed when the calcium: nitrogen ratio was estimated for specimens collected over a period of 12 weeks. The ratio nitrogen: ash was lower in leaves in the early stage of the disease and higher in those in an advanced stage and cannot, therefore, serve as a diagnostic character. Biometric measurements of the entire length of leaf blade including the petiole (L), petiole length (P), and the maximum breadth of leaf blade (B) were 63·2, 23·1, and 9·4 mm., respectively, in healthy leaves and 23·5, 6·2, and 2·3 mm., respectively, in fully spiked leaves from Bangalore, similar values being obtained for leaves from two other localities. The ratios L/B and $\frac{L-P}{B}$ are consequently significant diagnostic factors. Another striking feature of the diseased plant is a reduction of the internodal distance from between 16·4 and 29·8 mm. in the healthy plants, to between 3·1 and 7·2 mm., and, moreover, the internodes were set at quite regular intervals, unlike those of healthy plants. Neither the ratio L/B, the length of the petiole, nor the internodal distance alone was sufficiently reliable in identifying the disease, but a combination of the three was invariably satisfactory.

Brien (R. M.). **Black root-rot of Hops.**—*N.Z.J. Sci. Tech.*, A, xx, 1, pp. 62–64, 2 figs., 1938.

The fungus isolated from hops suffering from black root rot in Nelson Province, New Zealand, in 1936 was identified by S. F. Ashby as *Phytophthora cactorum*, apparently not previously recorded on this host. The first symptom of the disease is a rapid yellowing and wilting of the foliage, usually when the plants are coming into flower, followed by a brown discoloration of the leaves and death of the plants. Sharply defined black lesions, 3 to 12 in. long, were found completely encircling the decayed roots. Positive results were given by field and greenhouse inoculation tests in which pure cultures of the organism were introduced

into the roots either through the soil or by way of incisions near the crown.

Obando (N.). **Algunas consideraciones sobre la nueva enfermedad de la Caña de Azucar.** [Some considerations on the new Sugar-Cane disease.]—*Agricultura, Bogotá,* x, 12, pp. 362–363, 1938.

Energetic measures, based on plant quarantine and the investigation and propagation of resistant varieties, have been planned by the Department of Agriculture, Colombia, for the control of sugar-cane mosaic [see above, p. 12], which has caused a substantial reduction in yields since 1935.

Yamamoto (W.). **Some sooty moulds on Sugar Cane.**—*Ann. phytopath. Soc. Japan,* viii, 2, pp. 96–112, 16 figs., 1938. [Japanese, with English summary.]

At least three different species of sooty moulds appear to be associated with the aphid *Ceratovacuna lanigera* on sugar-cane leaves in Formosa, namely, the olivaceous (*Fumago vagans* Pers.) [cf. *Caldariomyces fumago*: *R.A.M.*, xi, p. 404], the black (*C. fasciculatus* n.sp. [with English and Latin diagnoses]), and the brownish (*Hypocapnodium* sp.).

F. vagans is characterized by simple, erect, yellowish- to dark brown, 3- to 16-septate conidiophores, more or less geniculate above, bearing concatenate, acropleurogenous, ellipsoid, ovoid, or oblong, continuous or uni-, rarely biseptate, pale fuscous to dark olive conidia, 5 to 16 by 3 to 6·5 μ, occasionally up to 23 μ, and by gemmoid, irregularly ellipsoid, ovoid, oblong, or subglobose, generally bi- to pluriseptate, olivaceous to dark brown, thick-walled chlamydospores, 7 to 23 by 5 to 19 μ.

The branched conidiophores of *C. fasciculatus* are aggregated into simple or rarely branched synnemata, tapering upwards, but more or less swollen at the apex, simulating pycnidia, 210 to 476 by 22 to 41 μ (at the base); and bear ellipsoid or ovoid, continuous, hyaline conidia, 4·3 to 7·8 by 2·2 to 4·3 μ; the gemma-like, irregularly ellipsoid, oblong, or ovoid, dark olive, continuous or uniseptate chlamydospores measure 7 to 16 by 3·5 to 8 μ.

Inoculations on potted sugar-cane seedlings with a solution of 5 per cent. mixed honey dew and 2·5 per cent. peptone containing conidia from onion agar cultures resulted in the formation of patches similar to those arising under natural conditions and bearing the typical conidia of the organisms concerned.

Sydow (H.). **Novae fungorum species—XXVI.** [New species of fungi—XXVI.]—*Ann. mycol., Berl.,* xxxvi, 2–3, pp. 156–197, 1938.

This is a critically annotated list [cf. *R.A.M.*, xvi, p. 839] of 33 new species of fungi [with Latin and German diagnoses] collected by F. C. Deighton in Sierra Leone and C. G. Hansford in Uganda. An appendix furnishes similar information in respect of five Asterineae listed by Hansford in his current contributions [cf. ibid., xvii, p. 415] to the parasitic fungi of Uganda.

Sydow (H.). **Neue oder bemerkenswerte australische Micromyceten—III.** [New or noteworthy Australian micromycetes—III.]—*Ann. mycol., Berl.*, xxxvi, 4, pp. 295–313, 1938.

In this critically annotated list of 24 new or otherwise remarkable Australian fungi, the author erects 6 new genera and 18 new species [with Latin diagnoses]. *Septoria polyadelpha* Syd. n.sp. forms greenish-grey lesions, often covering almost the entire surface, on the leaves of *Brassica sinapistrum* [charlock: *B. sinapis*] in the Pennant Hills, New South Wales, usually causing shrivelling and death. The fungus is characterized by pycnidia 70 to 150 μ in diameter, the outer walls pale yellow to olive-brown, the inner ones hyaline; branched, septate hyphae, 3 to 5 μ in width; and broadly filiform, obtusely rounded, more or less vermiform, or falcate to curved, rarely almost straight, uni- to triseptate, hyaline conidia, 22 to 30 by 2 to 2·5 μ.

Tobisch (J.). **Beiträge zur Kenntnis der Pilzflora von Kärnten. V.** [Contributions to the knowledge of the fungus flora of Carinthia. V.]—*Öst. bot. Z.*, lxxxvii, 4, pp. 273–315, 1938.

In this further contribution to a series of critical annotations on the fungus flora of Carinthia, Austria, the author records *Ascochyta pteridis* causing a blackish-brown discoloration of bracken (*Pteridium aquilinum*) fronds and stems, rapidly followed by the death of the affected parts; the conidia measure 12 to 20 by 4 to 6 μ. Living *Malus* [*Pyrus*] leaves are attacked by *Asteroma mali* Desm., which produces circular, blackish lesions, 3 to 5 mm. in diameter, with black, branched fibrils radiating outwards from the centre. The brown pycnidia of the fungus measure about 100 μ in diameter and are furnished with a short, obtusely papillate ostiole; the dimensions of the ellipsoid, oblong, or ovoid conidia are 4 to 7 by 2·5 to 3 μ. *Sphaeropsis ellisii* on pine (*Pinus sylvestris*) needles and their supporting twigs is comparable with *Diplodia pinea* [*R.A.M.*, xvii, pp. 150, 573] but in the author's material the conidia were invariably unicellular [cf. ibid., xvi, p. 148]. *Colletotrichum nigrum* occurs on ripe chilli (*Capsicum annuum*) capsules [ibid., xvii, p. 346].

Mundkur (B. B.). **Fungi of India. Supplement I.**—*Sci. Monogr. Coun. agric. Res. India* 12, 54 pp., 1938. Rs. 1–6 or 2*s*. 3*d*.

This supplement to Butler and Bisby's Fungi of India [*R.A.M.*, xi, p. 545] adds 433 records of Eumycetes, making a total of 2,784, and 90 records of Myxomycetes. *Mycosphaerella tinosporae* Ajrekar n.sp. is described as the perfect stage of *Cercospora tinosporae* Syd. *Peronospora gäumannii* Mundkur nom. nov. is a new name for *P. indica* Gäum. (non Syd.) on *Argemone mexicana*. *Cerebella sorghi-vulgaris* Subramaniam, *Vermicularia bakeri* Syd., and *Phaeosaccardinula butleri* (Syd.) Theiss. & Syd. are renamed, respectively, *C. volkensii* (P. Henn.) Mundk. n.comb., *Colletotrichum bakeri* (Syd.) Mundk. n.comb., and *Chaetothyrium butleri* (Syd.) Mundk. n.comb. Additional notes or corrections are given for several fungi previously recorded for India. A bibliography of 134 titles and an index of genera are appended.

CIFERRI (R.). **Mycoflora domingensis exsiccata (Cent. III, No. 201–300.).** [Exsiccata of the Dominican mycoflora (Cent. III, Nos. 201–300).]—*Ann. mycol., Berl.*, xxxvi, 2–3, pp. 198–245, 1938.

This critically annotated list of 124 species, varieties, or forms of fungi on 116 hosts, based on the examination of 120 exsiccata of collections in the Dominican Republic [cf. *R.A.M.*, xi, p. 604], contains 2 new genera and 32 new species [with Latin diagnoses]. Most of the species are stated to be new to the country and a few to the Americas. The following items may be mentioned. *Pseudoperonospora cubensis* is very prevalent on cultivated and semi-wild squashes. *Elsinoe canavaliae* [*E. phaseoli*] occurs on *Phaseolus lunatus* [ibid., xiii, p. 345].

Referring to the subdivision of *Meliola* by the late F. L. Stevens into four genera, viz., *Meliola*, *Irenina*, *Irene*, and *Irenopsis*, on the basis of the presence or absence of perithecial or mycelial setae or vermiform perithecial appendages [ibid., vii, p. 743], the author, while accepting this method of classification, proposes to reduce the genera to subgenera. These ideas will be further developed in a paper dealing with Dominican Meliolineae; in the meantime a key is furnished showing the subgenera, sections, and subsections arranged according to their morphological characters.

Septobasidium spongia is widespread on oranges, usually in conjunction with other species of the same genus, and with or on scale insects. *Melia azedarach* leaves are attacked by *Cercoseptoria domingensis* n.sp., which causes polygonal to polygonoid or irregular, white to greyish spots 2 to 4 mm. in diameter, with a brownish halo ½ to 1 mm. wide. A leaf spot of *Argemone mexicana* is caused by the fungus hitherto known as *Cladosporium guanicensis* (*Trans. Ill. Acad. Sci.*, x, p. 207, 1917), but for which the name *Polythrincium guanicense* (Stev.) Cif. n.comb. is proposed, even though the agreement with *P.* [*Dothidella*] *trifolii* [*R.A.M.*, iv, pp. 96, 396, 446; xvii, p. 440] is not complete. *Cercospora viciae* and *C. rosicola* occur on cultivated *Lathyrus* and roses [ibid., xvii, p. 112], respectively.

Bitter orange leaves, twigs, and fruits are liable to infection by *Sphaceloma citri* (Butl.) Cif. n.comb. (syn. *Sporotrichum citri* Butl., *Sphaceloma fawcettii*).

A new form of *Rhizoctonia* [*Corticium*] *solani*, *R. solani* f. *paroketea*, differing from the type in its peculiar habitat, the apparent absence of a *Moniliopsis* stage [ibid., xvii, p. 183], and some secondary morphological characters, is found in the starch residues of cassava roots.

HIRATA (K.). **A general view on the host range of powdery mildews.**—*Ann. phytopath. Soc. Japan*, viii, 2, pp. 170–178, 1938. [Japanese.]

A tabulated conspectus is given of the reaction of nearly 100 families of the Dicotyledoneae and four of the Monocotyledoneae to infection by seven genera of the Erysiphaceae, viz., *Erysiphe*, *Leveillula*, *Sphaerotheca*, *Microsphaera*, *Podosphaera*, *Uncinula*, and *Phyllactinia*. A two-page bibliography is appended.

BITANCOURT (A. A.) & JENKINS (A[NNA] E.). **New species, hosts, and distribution records of Elsinoë and Sphaceloma.**—*Chron. bot.*, iv, 4–5, pp. 388–389, 1938.

A list is given of hosts belonging to 24 families (in addition to undetermined hosts) on which species of *Elsinoë* and *Sphaceloma* have been recorded since the publication of the authors' previous list [*R.A.M.*, xvii, p. 70], the locality where the record was made being indicated in each case.

COUCH (J. N.). **The genus Septobasidium.**—480 pp., 115 pl., 20 figs., 2 graphs, Univ. N. C. Pr., Chapel Hill, 1938. $5.00.

This monograph presents detailed descriptions with photographs and line drawings of about 175 species of *Septobasidium* [*R.A.M.*, xv, p. 58]. Of these about 90 are re-descriptions of the old original types, most of which have never been adequately described or illustrated, 27 are descriptions of species, which have already been described by the author, and 55 are new species [but without Latin diagnoses]. The volume further contains a discussion of the fungus-insect relationship, and of the pathological considerations and control methods; data on geographical distribution, host trees, and host insects; sections on structural features of taxonomic importance, hybridization, and cytology; and a key to the species.

ULBRICH (E.). **Die von der deutschen Himalaya-Expedition 1937 gesammelten Pilze.** [The fungi collected by the German Himalaya expedition of 1937.]—*Notizbl. bot. Gart. Berl.*, xiv, 122, pp. 139–150, 1938.

A critically annotated list is furnished of twelve fungi collected by Prof. C. Troll, geographer and botanist of the German Himalaya expedition, at an altitude of 2,500 to 4,500 m. above sea-level in the Nanga Parbat region of the Kashmir Gilgit Dependency. One new genus (*Trolliomyces*) is included, based on *T. rosae* (Barcl.) n.comb. (*Puccinia rosae*) on roses [*R.A.M.*, xiii, p. 185], the malodorous pycnospores of which probably serve to attract the insect visitors acting as spore carriers. *Chrysomyxa pyrolae* [ibid., xi, p. 214] was detected on the foliage of *Pyrola rotundifolia*, and *Melampsora salicis-wallichianae* n.sp. on the young leaves and female catkins of *Salix wallichiana*, both in the uredo stage only. Slight swellings on juniper branches bore teleutosori of *Gymnosporangium confusum* [ibid., xi, p. 145]. *Aecidium colchici-aurei* n.sp. occurred on the leaves of *Colchicum aureum*, this being apparently the first record of the aecidial stage of a rust on *Colchicum*. Latin diagnoses are given for the new genus and species. Attention is drawn to the general floristic, ecological, and biological resemblances between the fungi studied and those recently described by Nattrass from Cyprus [ibid., xvii, p. 346].

DUFRÉNOY (J.). **Les conceptions actuelles sur les virus du Tabac.** [The present conceptions regarding the viruses of Tobacco.]—*Ann. Epiphyt.*, N.S., iv, 2, pp. 267–279, 5 figs., 2 diags., 1938.

The author reviews recent literature [most of which has been noticed in this *Review*] dealing with the structure and chemical and optical

properties of the nucleoproteins present in the tissues of tobacco plants affected with tobacco viruses no. 1, no. 6, or 'enation virus', as well as with their inactivation by heat or by chemical reagents. He suggests that proteinases may play a part in the multiplication of the virus protein when introduced into a susceptible plant.

BAWDEN (F. C.) & PIRIE (N. W.). **A note on some protein constituents of normal Tobacco and Tomato leaves.**—*Brit. J. exp. Path.*, xix, pp. 264–267, 1938.

In isolating a number of viruses from infected White Burley tobacco and Kondine Red tomato plants [cf. *R.A.M.*, xvii, pp. 564, 566, 619] the authors found that the proteins characteristic of the viruses isolated differed markedly from the proteins of normal plants and could be easily isolated; others, however, particularly those of the relatively unstable insect-transmitted viruses, such as potato virus Y, cucumber virus 1, and *Hyoscyamus* virus 3, had properties more closely resembling normal plant proteins, and their isolation presented a more difficult problem.

The molecules of some proteins from normal tobacco and tomato plants are large, being readily sedimented from neutral solution by high-speed centrifugation. The sedimented material gives brown jellies similar in appearance to those obtained by centrifuging crude virus preparations. The jellies are isotropic, and are readily dissolved or dispersed in water. These apparently homogeneous proteins with high molecular weights are probably normal constituents of many plant species, and their existence casts doubt on the purity of virus preparations made solely by high-speed centrifugation of infective sap. The authors found them in healthy and virus-infected tobacco and tomato plants; the materials centrifuged from cucumbers by Price and Wyckoff [ibid., xvii, p. 647] and from peas and beans by Loring, Osborn, and Wyckoff [ibid., xvii, p. 578] are, presumably, proteins of a similar nature. Wyckoff, Biscoe, and Stanley found no such proteins in tobacco and stated that healthy tobacco sap contains no molecules of greater weight than 30,000 [ibid., xvi, p. 415], but their treatment of the leaves before expressing the sap may account for this. As these normal plant proteins and the bushy stunt virus [ibid., xvii, p. 566] are denatured by freezing, it would seem that freezing the tissues may be a dangerous preliminary to investigations on the labile protein constituents of plants, though in isolating viruses unaffected by freezing and thawing the method may provide a useful fractionation.

Apart from high molecular weight these normal plant proteins bear little resemblance to the plant viruses so far isolated. All the viruses obtained by the authors in crystalline or liquid crystalline form have been nucleoproteins. The normal plant proteins differ from the viruses in being comparatively poor producers of antibodies when injected intravenously into rabbits. In discussing the suggestion that viruses might be portions of nuclear material or the naked nuclei of hypothetical small bacteria [ibid., xvii, p. 761], the authors point out that the nucleic acids characteristic of nuclei contain desoxypentose whereas all the plant viruses isolated contain a nucleic acid of the ribose type. The fact that there is no change in the total protein content

of infected leaves comparable with the change in the content of soluble protein [ibid., xvii, p. 630] suggests that infection changes the ratio of soluble to insoluble protein, and it is thought that a detailed study of the normal insoluble nucleoproteins of the cell might, perhaps, supply information on the mechanism by which the abnormal nucleoproteins are formed in the infected plants.

LAUFFER (M. A.) & STANLEY (W. M.). **Stream double refraction of virus proteins.**—*J. biol. Chem.*, cxxiii, 2, pp. 507–525, 1 fig., 2 diags., 1 graph, 1938.

Using an almost completely mechanized modification of Takahashi and Rawlins's method of measuring stream double refraction of flow [*R.A.M.*, xvi, p. 417], the writers observed this phenomenon in purified proteins isolated from tobacco plants infected by mosaic, aucuba mosaic of tomato, severe etch, tobacco ring spot, latent mosaic of potato, Holmes's masked tobacco mosaic, and a mild tobacco mosaic, but not in elementary bodies of vaccinia or the Shope rabbit papilloma virus protein. *Limulus* [*polyphemus*: see next abstract] and *Helix* haemocyanin, and hog thyroglobulin showed limited double refraction of flow when concentrated solutions were used.

The double refraction of flow in tobacco mosaic virus protein solutions [ibid., xvii, p. 563] appears to be attributable to the orientation of rods rather than to the photoelastic effect, since it occurs in solutions of relatively low viscosity and no direct correlation could be detected between change in viscosity and alteration in stream double refraction. Moreover, a time lag in the disappearance of double refraction was observed after the cessation of streaming, especially in systems near the isoelectric point. Double refraction was further found to persist after the passage of a stream of virus solution from a pipette into the air, thereby showing that the process is not directly dependent on shear, and hence that it is not due to the photoelastic effect.

Upon standing, relatively concentrated solutions of tobacco mosaic virus protein separated into two layers, of which the lower is spontaneously doubly refracting, confirming Bawden and Pirie's observations [ibid., xvii, p. 564].

SEASTONE (C. V.). **The measurement of surface films formed by hemocyanin, Tobacco mosaic virus, vaccinia, and Bacterium gallinarum.**—*J. gen. Physiol.*, xxi, 5, pp. 621–629, 3 graphs, 1938.

Using the Langmuir tray (*J. Amer. chem. Soc.*, xxxix, p. 1848, 1917) with certain minor modifications, the author measured the surface film areas formed by haemocyanin from *Limulus polyphemus*, ultracentrifuge-purified tobacco mosaic virus protein [see preceding abstract], vaccinia elementary bodies, and a suspension of *Bacterium gallinarum* (fowl typhoid), in comparison with pepsin and ovalbumin.

The following were the areas (in sq. m.) covered by 1 mg. spread of the different proteins or protein-containing particles on 90 per cent. saturated ammonium sulphate: pepsin 1·00, ovalbumin 1·07, haemocyanin 0·27, tobacco mosaic 0·06, vaccinia 0·13, and *Bact. gallinarum* 0·07. The tobacco mosaic virus was experimentally shown to remain on the surface of the solution notwithstanding the extremely small film

developed by this material. Data are presented from which it is tentatively concluded that the tobacco mosaic virus protein consists of a monolayer of vertically arranged rod-shaped molecules.

WYCKOFF (R. W. G.). **An ultracentrifugal analysis of the aucuba mosaic virus protein.**—*J. biol. Chem.*, cxxiv, 3, pp. 585–588, 1938.

The proteins of the aucuba and ordinary strains of the tobacco mosaic virus are similar but not identical in their ultracentrifugal behaviour [*R.A.M.*, xvii, pp. 207, 564], the former being more readily damaged by salts than the latter and remaining in an unaltered state only where quantity ultracentrifugation is carried out with distilled water as an intermediate solvent. Such a preparation gives the single sharp boundary indicative of one molecular species and has a sedimentation constant about 4 per cent. greater than that of the ordinary mosaic strain protein. The aucuba mosaic protein sediments rather more rapidly with $^{s}20° = 185 \times 10^{-13}$ cm. sec.$^{-1}$ dynes^{-1} than that of ordinary mosaic ($^{s}20° = 174 \times 10^{-13}$), the same being the case with the secondary boundary, $^{s}20°(2) = 220 \times 10^{-13}$, as compared with $^{s}20°(2) = 200 \times 10^{-13}$. The molecules of the two strains have nearly the same regions of P_H stability.

HOLMES (F. O.). **Inheritance of resistance to Tobacco-mosaic disease in Tobacco.**—*Phytopathology*, xxviii, 8, pp. 553–560, 1 fig., 1938.

This is an amplified account of work already noticed from other sources [*R.A.M.*, xvi, p. 417; xvii, p. 417].

GOLDIN (M. I.). Некоторые данные о кристаллических включениях при вирусе мозаики Табака. [Some data concerning crystalline inclusions in the mosaic virus disease of Tobacco.]—*Микробиол.* [*Microbiol.*], vii, 3, pp. 353–359, 1938. [English summary.]

In connexion with studies on the crystalline inclusions of mosaic-diseased tobacco at the Microbiological Institute of the U.S.S.R. Academy of Sciences, Moscow, the author detached from a tomato shoot, with the aid of a micromanipulator, groups of 15 to 20 hairs with and without Ivanovsky's crystals, and found that only the former were capable of infecting *Nicotiana glutinosa* leaves. Similar results were obtained by the same method with epidermal fragments of mosaic tobacco plants. These data are regarded as fully confirming Livingston and Duggar's observations as to the close connexion between the presence of inclusions and the concentration of the tobacco mosaic virus in the tissues of diseased plants [*R.A.M.*, xiv, p. 799]. Treatment of hairs with 0·1 N mercuric chloride resulted in the production of Stanley's crystals only in those hairs previously occupied by Ivanovsky's crystals [ibid., xvi, p. 569].

The alleged solubility of Ivanovsky's crystals was found to result solely from injury to the enveloping cells, e.g., by mechanical rupture or treatment with ether, chloroform, acids, or alkalis. Both Ivanovsky's and Stanley's crystals may be stabilized in the plant tissues with the help of picric acid or other reducing substances. Investigations on the masking of mosaic showed that plants in which the symptoms of the disease are suppressed contain larger amounts both of the virus and

of Ivanovsky's crystals, the detection of which may be utilized for diagnostic purposes.

GUMAER (W.). **Control of blue mould of Tobacco with benzene vapour.**—*Industr. Engng Chem.*, xxx, 9, pp. 1076–1081, 4 figs., 3 diags., 5 graphs, 1938.

From recent observations in Connecticut the writer concludes that the evaporation ratio (area of evaporation surface to area of plant bed) is a poor indication of the benzene vapour concentration in a tobacco plant bed. The percentage of benzene vapour in the atmosphere of a plant bed is an accurate measure of the efficacy of benzene treatment of blue mould (*Peronospora tabacina*) [*R.A.M.*, xvii, p. 845], irrespective of weather conditions and gas-tightness of the bed. All fresh sporulation is arrested in two nights with a vapour concentration of 0·05 per cent. throughout the night. A special Mine Safety Appliance combustible gas indicator, calibrated for benzene, has been found satisfactory for measuring benzene in tobacco plant beds. Wetting cloth covers at sunset greatly increases the vapour concentration, which can then be maintained at the desired strength until morning, except with very light cloth (42×44 mesh), even on dewless nights. Washing new cloth to increase its wettability more than doubles the vapour concentration. Unbleached sheeting, 56×60, is recommended as the cheapest standard cloth retaining sufficient vapour in the bed while permitting the penetration of night rains through the cover. Tightness of the cover is more important than the distance between evaporators and the evaporation ratio. With tight covers benzene evaporators may be placed 12 to 15 ft. apart. Washed and wetted, 56×60 mesh cloth is more gas-tight than glass sash, though the latter shows increased efficacy when wet owing to the infiltration of water into the cracks between overlapping panes. A wick evaporator has been developed giving a more uniform vapour distribution in the plant bed and a higher vapour concentration on cold nights, besides avoiding plant damage from excessive vapour on hot nights and from spilling benzene, and presenting various other advantages. All symptoms of blue mould were prevented by the use of the contrivance for 20 sq. yds. of plant bed, the benzene consumption being 10 c.c. per sq. yd.

ALLAN (J. M.), HILL (A. V.), & ANGELL (H. R.). **Downy mildew (blue mould) of Tobacco: its control by benzol and other vapours in covered seed-beds. IV.**—*J. Coun. sci. industr. Res. Aust.*, xi, 3, pp. 247–253, 1938.

In further experiments for the control of downy mildew of tobacco (*Peronospora tabacina*) [see preceding abstract] the best results were again obtained with benzol, which was equally effective when evaporated from troughs or from cans, the effect being greater when many centres of evaporation were used. An evaporation surface ratio of 1 to 100 was sufficient under average conditions but one of 1 to 72 may be necessary when the conditions are very favourable to the disease. The use of benzol on alternate nights has proved satisfactory in two seasons' experiments but further work is required to determine whether this procedure may safely be adopted. Calico seed-bed covers treated

with cuprammonium (5 per cent. copper sulphate in water+strong ammonia to dissolve the precipitate) did not show fungal contamination, while covers treated with shirlan or kharki (chrome alum ½ lb., ferrous sulphate ½ lb., pyrolignite of iron ½ lb., water 2 gals., followed by treatment with sodium silicate 1½ lb. in 2 gals. water) were slightly affected.

ATKINSON (H. J.) & ROBINSON (C. H.). **Soil studies of brown root rot of Tobacco. I. Effect of certain crop residues on some forms of nitrogen.**—*Sci. Agric.*, xviii, 12, pp. 685–694, 1938.

After briefly reviewing earlier investigations into tobacco brown root rot [*R.A.M.*, xvii, p. 774] and referring to Beaumont's hypothesis that the disease results from the presence of unoxidized forms of nitrogen in the soil, due to the decomposition of plant residues, which set up conditions in the roots that induce attack by decay organisms [ibid., xvi, p. 67], the authors give a fully tabulated account of laboratory experiments in which soil samples were treated with the ground-up stubble and roots of maize, timothy [*Phleum pratense*], oats, and lucerne and analyses made at intervals for ammonia, nitrite-nitrogen, and nitrate-nitrogen. The soils were maintained at about 60 per cent. of their water-holding capacity, and two series were kept at room temperature (20° to 25° C.) and the third at about 10°.

The results obtained showed that the addition of the plant residues did not cause any appreciable accumulation of ammonia or nitrites in the soil, except in the case of lucerne stubble, which, however, also gave a large accumulation of nitrate-nitrogen. All residues depressed the initial accumulation of nitrates, but the effect of lucerne lasted only a short time, that of maize was less lasting than that of timothy, and oats caused the most prolonged effect of all.

Brown root rot has been reported to be favoured by a low temperature but incubation of the soil samples at 10° did not cause any accumulation of ammonia or nitrites and nitrates accumulated possibly rather more slowly than usual. The authors conclude that residues of maize and timothy (both crops liable to predispose a subsequent tobacco crop to brown root rot) exert no more pronounced effect on the three forms of nitrogen studied than do oat residues.

REID (W. D.). **Bacterial-canker of Tomatoes.**—*N.Z. J. Sci. Tech.*, A, xx, 2, pp. 69–74, 3 figs., 1938.

A brief account is given of the symptoms of bacterial canker of tomatoes (*Aplanobacter michiganense*), first observed in Auckland, New Zealand, in 1936, together with a technical diagnosis of the causal organism, which agrees in all essential features with earlier descriptions [*R.A.M.*, x, p. 415], and recommendations for control, based on overseas experience.

LESLEY (J. W.) & WALLACE (J. M.). **Acquired tolerance to curly top in the Tomato.**—*Phytopathology*, xxviii, 8, pp. 548–553, 1 fig., 1938.

When young tomato plants growing in the field are inoculated in late spring with the virus of [beet] curly top [*R.A.M.*, xv, p. 123], in about 12 days the leaves become rolled, the plant turns sulphur-yellow, growth is checked, the flowers and buds drop, and the fruit colours

prematurely. Plants that have already matured fruit, and those raised from cuttings of more mature plants are less readily infected. Affected plants generally succumb, but in some cases a partial 'recovery' appears to take place, i.e., a process of regeneration in which relatively healthy shoots arise from the leaf axils. New, apparently healthy shoots sometimes arise from the lower nodes of severely diseased plants after almost all the top growth has died. If recovery occurs early enough in the season, and if the growth of the regenerated parts is more or less normal, the plant may yield mature fruit. The new growth, especially at first, may be feeble and yellowish, or it may be fairly healthy, with a slight yellow and purple tinge. A relapse may occur, and the plant die.

Recovery by regeneration appears to be influenced by weather conditions and the stage of growth of the plants when the symptoms develop, but it is also a racial characteristic. In a wild race from western Mexico, Guasave A, from 55 to 100 per cent. of the plants recovered in different years. Clones from plants that have recovered by regeneration appear to show a resistance or tolerance not present in clones from disease-free, uninoculated plants.

Full details are given of experiments during the years 1934 to 1937 in which inoculation of recovered plants failed to produce severe symptoms, and the evidence obtained indicated that the presence of the virus in regenerated plants is a prerequisite for acquired tolerance. Plants of a recovered clone grow slowly and show mild curly top symptoms characteristic of regenerated shoots, but may be fairly productive.

Dufrénoy (J.). **Le 'spotted-wilt'.** [Spotted wilt.]—*Ann. Épiphyt.*, N.S., iii, 2, pp. 187–223, 21 figs., 3 graphs, 1937. [Received October, 1938.]

In this detailed account of his studies on tomato spotted wilt in south-western France [*R.A.M.*, xvi, p. 284] the author emphasizes the wide host range of the virus, and describes the symptoms it produces on a number of ornamental plants, which constitute a menace to tobacco and tomato crops in their vicinity by acting as reservoirs of infection. In an inoculation experiment performed by rubbing the 13th leaf of a healthy tobacco plant with infective juice (from a tobacco plant showing chlorotic rings and growing near some plants of *Callistephus sinensis* [*C. chinensis*] affected with spotted wilt), the following series of symptoms developed: annular spots on the 12th leaf, mosaic on the 11th and 9th leaves, and an 'oak leaf' pattern on the 8th and 7th leaves, the younger leaves remaining healthy in appearance. In a similar experiment, using juice from an infected plant of *Physalis francheti*, the symptoms also included primary dark brown lesions along the veins of the leaves, crinkling of the leaf blades, and cankers on the mid-ribs and stems. Secondary shoots developing in the axils of the leaves became necrosed at the base, and their leaves developed the 'oak leaf' pattern.

The cytological changes accompanying these symptoms are fully described, the main features being the formation of suberized layers in the tissues adjacent to the veins, and the progressive series of changes

in the palisade and mesophyll cells accompanying the development of chlorosis and necrosis. These changes are interpreted as being due to oxidation processes culminating in the precipitation of phenolic compounds, and are intensified in plants receiving potassium and phosphoric fertilizers, and exposed to sunlight. In plants receiving nitrogen the necrotic symptoms do not develop, and the virus tends to become systemic.

In the concluding sections of the paper the serological and immunological reactions of the virus, its physical properties and inactivation, and the phenomenon of acquired immunity in tobacco are summarized and discussed.

Berger (G.). **Une maladie de la Tomate : la nécrose du collet due à l'Alternaria solani Sorauer dans la région de Casablanca et de Fédala (Maroc).** [A disease of Tomato: collar necrosis due to *Alternaria solani* Sorauer in the region of Casablanca and Fédala (Morocco).]—*Ann. Épiphyt.*, N.S., iii, 2, pp. 225–230, 1 fig., 1937. [Received October, 1938.]

For several years past serious losses have been caused in the vicinity of Casablanca and Fédala, Morocco, by the collar rot phase of tomato early blight (*Alternaria solani*) [*R.A.M.*, vii, p. 411; xiii, p. 195; xv, p. 633; xvii, p. 778]. Infection is most prevalent in autumn sowings in nurseries.

The disease develops as soon as the plants appear above the soil, but becomes readily noticeable only on seedlings that are a few weeks old. Livid brown, later greyish, oval, sunken, often zonate lesions appear on the stem at or above the collar, and frequently result in girdling. Only the cortical tissues are affected, at any rate at first, and the young plants appear to show normal growth. As the necrosis spreads round the stem and upwards, the plants turn yellow, lose their foliage from the base upwards, and wilt. The stem may break off. Most of the plants affected while very young may live on in the nursery, growing slowly. If attacked at a later stage, they may fruit. If planted out deeply, such plants may develop new roots above the affected collar, but as a rule the plant turns yellow and dries up before the new roots have had time to form.

Infection occurs at, or above, but never below, soil-level. Infection at soil-level is probably due to mycelium on the soil surface, derived from diseased plant debris or spores from other plants in the vicinity. Definite evidence was obtained that the germ-tube can penetrate the intact or bruised epidermis of the host. The fungus becomes localized in the cortical layers, which, in plants surviving attack, dry up and flake off.

Under the local conditions, infection is favoured by the warm winters, and high atmospheric and soil humidity. Previous soil infection undoubtedly plays a large part.

Disinfection of soil, which had previously borne diseased tomatoes, with 2 per cent. formalin gave complete control, as against 15 and 30 per cent. infection in two control plots at the time of transplanting, and greatly increased the vigour of the seedlings, but the advantage of this form of control is much reduced by the likelihood of subsequent

infection. Dusting or spraying the plants as soon as they appear above the soil with some suitable fungicide would appear to offer the best protection.

CARTER (J. C.). **Verticillium wilt of woody plants in Illinois.**—*Plant Dis. Reptr*, xxii, 12, pp. 253–254, 1938. [Mimeographed.]

Among the 12 species of woody plants found to be infected by *Verticillium albo-atrum* in Illinois from 1931 to 1937, inclusive, are almond, elm, five species of *Acer*, *Catalpa speciosa*, and *Robinia pseudacacia*, the two last-named being new host records for the fungus.

KONING (HENRIETTE C.). **The bacterial canker of Poplars.**—*Meded. phytopath. Lab. Scholten*, xiv, pp. 3–42, 2 pl., 8 figs., 1938.

This is an expanded account of the author's study on the bacterial canker of poplar attributed to *Pseudomonas rimaefaciens* n. sp. [*R.A.M.*, xvii, p. 492]. In addition to the symptoms already noted, it is stated that the slime exuded from cracks and lenticels dries and hardens into a shiny layer in dry weather. Young branches are killed by the disease and cankers on older branches thicken and develop callus so that a very irregular crumbly structure is produced. Growth is renewed in subsequent years, the greatest development taking place in the spring and early summer. The bacteria spread in narrow lines in the wood or bark, and these in cross section appear as red points. Such lines may extend long distances beyond the cankered area, and cause fresh cankers to develop. Inoculations with bacterial suspensions gave positive results, and bacteria re-isolated from the branches above and below the place of inoculation, when re-inoculated, caused a canker. Artificial infection is difficult or impossible in December, January, and February.

The bacterium is described as a short motile rod with 1 to 3 polar flagella, single or in pairs, Gram-negative, non-acid-fast, and non-sporing. It is aerobic, rapidly liquefies gelatine, and peptonizes milk. It grows abundantly on beer wort agar and peptone-glucose-saccharose agar, producing a cream-coloured, filiform streak with lobate edge and sometimes beaded; the minimum, optimum, and maximum temperatures for growth are below 14°, 25° and between 30° and 37° C., respectively, and the thermal death point lies between 42° and 48°. The bacterium does not produce hydrogen sulphide; forms a small amount of indol; does not hydrolyse starch; never produces gas; forms acid in the presence of sugars; utilizes nitrogen from peptone, asparagin, urea, gelatine, glycine, nitrates, and ammonium salts, but not from casein, albumin, or leucine; does not reduce nitrates except in solutions of 0·1 per cent. potassium nitrate with 0·04 per cent. dipotassium hydrogen phosphate or 0·02 per cent. magnesium sulphate, and with either 0·4 per cent. sodium succinate or 0·4 per cent. calcium malate as the carbon source. It utilizes carbon from glucose, saccharose, glycerol, succinates, malates, citrates, and oxalates, but not from the higher carbohydrates. The colonies are round, convex, smooth, somewhat granular, with a hyaline edge.

The varieties *Populus brabantica* Houtzagers, *P. trichocarpa* Torrey & Gray, and *P. candicans* Ait. proved to be very susceptible. In

comparative studies on the fungus canker of the poplar, which is stated to be easily distinguishable from the bacterial canker by the regular callus round the wound, it was found that *Nectria coccinea* [cf. ibid., xiv, p. 478] was most frequently present, but *N. galligena* [ibid., xvii, p. 492] and *Botryodiplodia penzigii* also occur. Inoculations through wounds with both species of *Nectria* were successful, the strongest infection occurring in those made during September to November whilst January to March inoculations also gave good results but those performed in May to August were negative. Inoculations with *B. penzigii* resulted in symptoms similar to those of the *Nectria* species but the wood showed a blackish-purple discoloration.

On black Italian (*Populus nigra italica*) and balsam poplars bacterial infection is nearly always followed by *Nectria* and other fungi, and this explains why *Nectria* has been considered to be the chief cause of the disease in Holland. The slime exudations characteristic of bacterial canker are only visible during a short time of the year in rainy weather. In France the author found the bacterial cankers almost free from fungi, and the slime clots were found on poplars of the balsam group. Similar slime clots were observed on material of *P. eugenei* from England.

RÉGNIER (R.). **Contribution à l'étude des Peupliers et de leurs principaux ennemis. Origine et classification des Peupliers.** [A contribution to the study of Poplars and their chief enemies. The origin and classification of Poplars.]—*Ann. Épiphyt.*, N.S., iii, 4, pp. 507–549, 20 figs., 1937. [Received October, 1938.]

Following a detailed study of the classification of the poplars, the author in the concluding section of this paper discusses the reaction of various species and hybrids to the canker disease as it occurs in the Seine-et-Marne [*R.A.M.*, x, p. 567], referred to provisionally as 'pernicious canker', to distinguish it from the condition attributed to *Nectria galligena* in Holland and Belgium [see preceding abstract]. In recent studies at the Station Centrale de Pathologie végétale Lansade is stated to have isolated several organisms belonging to *Phomopsis* and *Nectria*, as well as bacteria, from the cankers, which may, it is thought, be due to an association of fungi and bacteria [ibid., xiii, p. 408].

Observations in a nursery showed that hybrids of the black poplars of the first and second degree are hardly, if at all, susceptible, whereas those of the third degree and most of the species of the '*tacamahacca* group' are seriously affected. The tertiary hybrids, which are the most susceptible, are usually male, while most of the female hybrids are resistant. Among the black poplars a hybrid that should be eliminated is the Caroline poplar of the Oise valley (× *P. eugenei*) [loc. cit.], while the male hybrid × *P. brabantica* is also susceptible. Smooth-barked, male trees of the type known as 'Régénéré blanc de l'Ourcq' are somewhat susceptible. 'Sarcé blanc' (thought to be a tertiary hybrid) appears to be resistant. The female regenerated trees belonging to × *P. regenerata* Henry are seldom dangerously attacked. The remaining species, varieties, and hybrids of black poplar seem, so far, to be resistant. Among white poplars, only *P. alba* var. *bolleana* appears to be susceptible. With proper selection and careful cultural practices

the author considers it should now be possible to develop resistant plantations.

Hopp (H.). **The formation of colored zones by wood-destroying fungi in culture.**—*Phytopathology*, xxviii, 9, pp. 601–620, 2 figs., 3 diags., 1938.

The microscopic study of the discoloured zones (defined as unnaturally coloured regions associated with a pathological factor) occurring in association with the decay of poplar (*Populus canadensis* var. *eugenei*) wood blocks in specially constructed humidity chambers [*R.A.M.*, xvi, p. 112] under strictly controlled conditions showed the phenomenon to be due to a vital process of the hyaline type of vegetative hyphae of the five fungi concerned, viz., *Fomes applanatus* [*Ganoderma applanatum*: ibid., xvii, p. 713; and above, p. 2], *F. fomentarius* [ibid., xvi, p. 645], *F. fraxinophilus, Polyporus hispidus* [ibid., xvii, p. 83], and *F. igniarius* [ibid., xvii, p. 358]. The zones consisted essentially of swollen, gnarled hyphae, associated with a brown pigment secreted by the mycelium. Coloration of the hyaline type of mycelium was induced by exposure of the hyphae to a current of air saturated with water, though the reaction was not one of oxidation. Within the wood such conditions obtained only in restricted layers, accounting for the development of pigmentation in discoloured zones or dark lines. A similar but more extensive type of coloration occurred in mycelium growing on agar surfaces and moist wood. An indirect influence on the process of coloration was exerted by the physical structure of the substratum and the relative humidity of the air. It is concluded from these studies that the coloration of the mycelium induces the discoloration of the wood, while the presence of zone lines (=black lines) of decay in the substratum is explained by the restriction of pigmentation. The term 'coloured zone' is proposed in place of 'pseudosclerotium' as used by Campbell [ibid., xvi, p. 137].

Wilkins (W. H.). **Studies in the genus Ustulina with special reference to parasitism. III. Spores—germination and infection.**—*Trans. Brit. mycol. Soc.*, xxii, 1–2, pp. 47–93, 1 fig., 13 graphs, 1938.

Spores of *Ustulina vulgaris* [see above, p. 1] collected from beech trees during a period of six months in each of three successive seasons were calculated, from an average of 518 spores, to measure $30{\cdot}82 \pm 0{\cdot}11$ by $7{\cdot}47 \pm 0{\cdot}03\ \mu$. The germinative capacity of the spores appeared to be very dependent on the age of the spores, being at its maximum with young mature spores and decreasing with age. Spores exuded in August and early September were mostly immature, but at the beginning of October the majority were mature. Viability persisted for about six months from October to March. The temperature for germination ranged from 10° to 35° C. with an optimum at 25 to 30°; the spores withstood 0°, but were killed very quickly at 45°. An analysis of outdoor temperatures in Oxford seemed to indicate the improbability of infection by spores, since, except for October, the temperatures during the sporing season usually approximate to or fall below the lower limit for germination (10° C.). Both in nature and in the laboratory a damp atmosphere was necessary for the emergence of spores from the

perithecia, and spores germinated only in water. Of several nutrient media tested, Leonian's secured maximum germination and each of its constituents tested separately also gave good results. The optimum hydrogen-ion concentration of the media for germination was found to be P_H 6, and the acid limit about P_H 2·5; the alkaline limit could not be determined but appeared to be beyond P_H 9.

Infection studies with seven different kinds of wood showed that spores of *U. vulgaris* could germinate on and penetrate both living and dead beech and lime wood; to a less degree elm, poplar, ash, and horse chestnut, but not oak. Infection by spores appears to be possible but not very probable in temperate climates, and it is suggested that the relative infrequency of the disease in these regions may be due to the temperature factor. The conidial stage also may play a role in infection, but this has not yet been investigated.

STEINMETZ (F. H.) & PRINCE (A. E.). **Observations on Willow blight in Maine, 1927 to 1938.**—*Plant Dis. Reptr*, xxii, 14, pp. 282–283, 1938. [Mimeographed.]

Observations in Maine from 1934 to 1938, inclusive, indicated that willow blight (*Fusicladium saliciperdum*) [*Venturia chlorospora*: *R.A.M.*, xvi, p. 590] is favoured by cool, wet weather, and suppressed by hot, dry conditions. Numerous trees in one heavily infected area were unaffected, relatively large stands of this type occurring along the Kennebec river at Waterville and Augusta. The susceptible type is considered to be *Salix alba* var. *vitellina*, while the resistant type is *S. fragilis*. Susceptible types, however, have also been identified as *S. fragilis*. Trees of the resistant type fit the general description of *S. fragilis*; they are staminate, and may belong to a single clone. Field observations show that this type and *S. pentandra* have survived in a vigorous condition in localities where susceptible types have succumbed.

PETRI (L.). **Il mal dell' inchiostro del Castagno.** [Ink disease of the Chestnut.]—*Ital. agric.*, lxxv, 8, pp. 527–532, 1938.

A semi-popular account is given of the ink disease of chestnuts (*Phytophthora cambivora*) and its control in Italy [see above, p. 1], with special reference to the extended cultivation of the Tamba variety of Japanese chestnut (*Castanea crenata*), both the fruit and wood of which are comparable in quantity and quality to the indigenous products.

Elm disease eradication in the United States.—*Chron. bot.*, iv, 4–5, pp. 429–432, 1938.

In this review of the campaign carried out in the United States against Dutch elm disease (*Graphium* [*Ceratostomella*] *ulmi*) [*R.A.M.*, xvii, p. 568] it is stated that up to 14th May, 1938, the number of dead and dying trees removed since the inception of the campaign in 1933 amounted to 2,630,893, and out of 218,798 suspects collected 28,407 were confirmed. It has been ascertained that *C. ulmi* may be present for several years without any visible sign of its presence, and trees with such hidden infection may transmit the disease to others by the agency

of insects. Thus, present methods of scouting, depending on observations of wilting, dying, or discoloured foliage, do not reveal every case of infection. It has further been shown that the disease can live and grow in dead elms for a period not yet determined.

BURGER (F. W.). **Iepensterfte in Nederland.** [Dying-off of Elms in the Netherlands.]—*Tijdschr. PlZiekt.*, xliv, 4, pp. 177–207, 2 pl., 2 diags., 1 map, 1938.

Tables are presented showing the comparative mortality from Dutch elm disease [*Ceratostomella ulmi*] in different years (extending back to 1920 in certain instances) in various parts of Holland [*R.A.M.*, xvii, p. 780], accompanied by a general discussion of the present situation and future possibilities of control. Whilst the present measures are helping to arrest the spread of the disease, the outlook for the future is not considered to be very promising, and a more intensive control campaign is advocated.

JENKINS (ANNA E.). **Emendations to the descriptions of Taphrina lethifera and T. aceris on Maple (Acer).**—*J. Wash. Acad. Sci.*, xxviii, 8, pp. 350–352, 2 figs., 1938.

Emended descriptions are given of *Taphrina lethifera* (Peck) Sacc. and *T. aceris* (Dearn. & Barth.) Mix, the only two species of *Taphrina* recorded on maples (*Acer*) in the United States [*R.A.M.*, iv, p. 527]. In addition to certain subsidiary characters omitted from the original descriptions of the two species, each possesses a stalk cell of which no mention had been made.

JENKINS (ANNA E.). **A new species of Taphrina on Sugar Maple and Black Maple.**—*J. Wash. Acad. Sci.*, xxviii, 8, pp. 353–358, 3 figs., 1938.

English and Latin diagnoses are given of *Taphrina sacchari* n.sp., the agent of a destructive leaf blight of black and sugar maples (*Acer nigrum* and *A. saccharum*), both species being attacked in Ohio and the latter also in twelve other States. The fungus is characterized by hypophyllous, cylindrical to clavate, rounded or truncate asci, 16 to 24 (sometimes 28) by 6·7 to 10 μ, with a variable stalk cell, 5 to 10 μ in height by 10 to 16 μ in width, and eight subglobose to elliptical ascospores, 6 to 7 by 4 to 5 μ. It is considered to be closely related to *T. acericola* [*R.A.M.*, iv, p. 527], known only on *A. campestre* from Italy. The lesions formed by *T. sacchari* on the leaves of its hosts are scattered, sometimes confluent, deciduous, up to 1·5 cm. in diameter, circular, subcircular, or irregular, pinkish-buff below and ochraceous-tawny above, with variations of cinnamon-buff, snuff-brown, clove-brown, bistre, or blackish-brown (Ridgway). The foliar spotting may be accompanied by an upward rolling of the lobes.

BORZINI (G.). **Osservazioni su di un seccume del Carpino nero (Ostrya carpinifolia Scop.).** [Observations on a wilt of Hop Hornbeam (*Ostrya carpinifolia Scop.*).]—*Boll. Staz. Pat. veg. Roma*, N.S., xviii, 1, pp. 131–145, 3 figs., 1938.

A serious wilt disease of *Ostrya carpinifolia* in Teramo, Italy, in 1937

is attributed by the author to *Valsa decorticans* Fr., the pycnidial form of which, *Cytospora decorticans* Sacc., was also present. Infection was promoted by the effect on the host of unfavourable soil and weather conditions.

ROTHBERG (M.). **A cultural study of Fistulina hepatica (Huds.) Fries, isolated from decayed Jarrah (Eucalyptus marginata, Sm.).**—*Proc. roy. Soc. Vict.*, N.S., l, 1, pp. 157–169, 2 pl., 2 figs., 1938.

Fistulina hepatica has been isolated (10 times in all) from the following types of jarrah (*Eucalyptus marginata*) rots in Western Australia [*R.A.M.*, xvii, p. 148]; heart or dry rot, pith or 'doze', straw rot, decayed included sap, yellow-edged pin-holes, and pencilled wood. In the writer's studies the fungus was grown in pure culture on 2·7 per cent. malt agar, the cultures being incubated for three to four weeks at 18° to 22° C. in subdued light at a relative humidity of 60 to 70 per cent., and some used as a substratum for inoculating sound blocks of jarrah. The colonies formed by the jarrah strain of *F. hepatica* are cartridge-buff to ochraceous-orange, later ochraceous-tawny to russet, instead of pinkish-cinnamon to straw-yellow, turning pale vinaceous-brown or russet, as in the oak strain described by Cartwright and Findlay [ibid., xvi, p. 4]. Other cultural differences include the occasional production by the *Eucalyptus* strain of typical fruit bodies (absent from the oak strain), as well as by others designated *Ceriomyces*-type, *Solenia*-type, *Cyphella*-type, and near-typical, the frequent formation of clamp-connexions and chlamydospores (scanty in the oak strain), and the absence of conidia (occurring in profusion in the isolations from 'brown oak'). The author considers that *F. hepatica* is the cause of the heart rot of jarrah, and experiments are in progress to ascertain its decay-inducing properties.

BUCHANAN (T. S.). **Annual growth rate of Cronartium ribicola cankers on branches of Pinus monticola in northern Idaho.**—*Phytopathology*, xxviii, 9, pp. 634–641, 1 graph, 1938.

An investigation conducted from 1933 to 1937 on the annual proximal growth increments of western white pine (*Pinus monticola*) blister rust (*Cronartium ribicola*) [see above, p. 3] branch cankers within the commercial range of the tree in northern Idaho yielded a total of 476 measurements from 15 series of calculations on 103 trees in six localities. All diameter classes between 0·01 to 0·10 and 1·11 to 1·20 in. were represented.

The graph depicting canker growth on branches of various sizes shows a straight-line trend, increments ranging from 1·26 in. on branches 0·10 in. in diameter to 2·49 in. on those measuring 1·20 in. 'Flagging' (cankers causing death of the foliage out to the tip of the distally supporting branch) and age of the cankers exerted no significant effect on proximal growth, though a tendency to increased growth rate accompanying advancing age of the cankers is suggested. The data herein presented are regarded as directly applicable to studies of blister rust damage on western white pines up to at least 30 ft. in height.

MIROV (N. T.). **Vegetative propagation of White Pine as a possible method of blister rust control.**—*J. For.*, xxxvi, 8, p. 807, 1938.

A brief note is given on the possibilities of the vegetative method of propagation of white pine (*Pinus strobus*) as a means of developing a strain immune from blister rust [*Cronartium ribicola*: see preceding and next abstracts]. Preliminary tests in California with 3- or 4-in. long branches from 10-year-old trees rooted in coarse sand have proved the physiological feasibility of the process, which is considered to afford some promise of eliminating the undesirable tendencies to rust susceptibility commonly inherent in the progeny of trees multiplied by sexual reproduction.

KLEBAHN (H.). **Offene Fragen und neue Beobachtungen über die rindebewohnenden Blasenroste der Kiefern.** [Open questions and new observations on the bark-inhabiting blister rusts of Pines.]—*Z. PflKrankh.*, xlviii, 8, pp. 369–410, 10 figs., 1938.

The author summarizes and discusses the present status of knowledge on the blister rusts of pines. The three best-known European rusts are: *Peridermium cornui* (*Cronartium asclepiadeum*) [*R.A.M.*, xvii, p. 281], the latter name being, in the opinion of the author, preferable to *C. flaccidum* because of the inadequacy of the early diagnosis of this species, which antedates *C. asclepiadeum* by only a few months; the autoecious *P. pini* [ibid., xvii, p. 214]; *P. strobi* (*C. ribicola*), *P. pini* f. *montanae* and several other European rusts seem to be of doubtful validity, whereas *C. gentianeum* on *Gentiana asclepiadea* may prove to have an unrecorded aecidial stage on pine. *Uredo quercus* [ibid., xvi, p. 207], found in Europe, is not considered to be synonymous with the American rust *P. cerebrum* [ibid., xii, p. 68], since neither teleutospores nor the *Peridermium* stage have so far been found in Europe. Asiatic rusts include *P. cerebrum* with its teleuto stage *C. quercuum* [ibid., xv, p. 63], *P. kurilense* [ibid., vii, p. 207], *P. indicum* [ibid., xvi, p. 146], and *P. himalayense* [ibid., xiii, p. 340]. Pine blister rusts occurring in America, according to Arthur, are *P. strobi* (*C. ribicola*), *P.* sp. (*C. comptoniae*) [ibid., xvii, p. 360], *P. cerebrum* (*C. quercuum*), *P.* sp. (*C. occidentale*) [ibid., xvii, p. 150], *P.* sp. (*C. comandrae*), and *P. harknessii* (*C. coleosporioides*) [ibid., v, p. 264]. Some less thoroughly studied American rusts are *P. weizii*, *P. guatemalense*, and the Woodgate *Peridermium* [ibid., xvii, p. 572].

In the concluding sections the author discusses the forms of development exhibited by these rusts, viz., strict and facultative heteroecism and autoecism, and describes observations on the nuclear behaviour of *P. cornui* (*C. asclepiadeum*) and *P. pini*. Contrary to general observations, the author has repeatedly succeeded in finding spermogonia of *P. pini*.

HADDOW (W. R.). **On the classification, nomenclature, hosts and geographical range of Trametes pini (Thore) Fries.**—*Trans. Brit. mycol. Soc.*, xxii, 1–2, pp. 182–193, 1938.

The author gives a list of 20 synonyms of *Trametes pini* (Thore) Fries, including *Fomes pini* Karsten (1882), a nomenclatorial combination wrongly credited to Lloyd (1915) [*R.A.M.*, xiv, p. 66; xv, p. 694;

xvi, p. 848]. An outline of the history of the nomenclature of the species is followed by a list of specimens studied in several herbaria. The world distribution of the fungus on its wide range of coniferous hosts is discussed in some detail, whence it appears that the fungus is generally distributed throughout the coniferous regions of the northern hemisphere, but has not been reported (apart from one record of questionable authenticity) in the southern hemisphere.

Blokhuis (J. L. W.). **Bastbeschadigingen aan Japanschen Lariks en Eik.** [Cortical injuries on Japanese Larch and Oak.]—*Ned. Boschb.-Tijdschr.*, xi, 8, pp. 352–354, 1 fig., 1938.

In connexion with the detection of *Fomes annosus* in a ten-year-old Japanese larch [*R.A.M.*, xvi, p. 358] stand in Holland, the writer draws attention to the extreme delicacy of the cortex of this species and its liability to injury through such environmental conditions as extremes of temperature (alternating strong sunshine and severe night frosts in the case in point), the actual damage from the fungus being secondary. Many instances of suspected canker [*Dasyscypha willkommii*: see next abstract] are believed to be attributable to careless handling. Larches should never be planted on old agricultural land, where extensive root rot is apt to occur (40 per cent. in a 13-year-old stand in one locality under observation).

A brief note is given on frost canker in oaks.

Rădulescu (A.). **Apariţia cancerului Laricei in România.** [The appearance of Larch canker in Rumania.]—*Rev. Padurilor*, l, 7–8, pp. 661–666, 3 figs., 1 map, 1938. [French summary.]

Larch canker (*Peziza*) [*Dasyscypha*] *willkommii* [*R.A.M.*, xvii, p. 640, and preceding abstract] was first observed in 1934 affecting some 60 per cent. of the 25- to 40-year-old stands in the Prahova Valley. In agreement with Münch, the writer ascribes the development of the disease to the use of seed of unsuitable origin, the material for the plantings under observations (1,050 m. above sea-level) having been procured from a disproportionately high elevation (1,600 m.) in the Tyrol.

Callen (E. O.). **Some fungi on the Yew.**—*Trans. Brit. mycol. Soc.*, xxii, 1–2, pp. 94–106, 1 pl., 3 figs., 1938.

The several fungi discussed in this paper were obtained from leaves of yew trees (*Taxus baccata*) near Edinburgh and studied in pure culture. *Sphaerulina taxi* grew more rapidly at first on yew extract agar than on malt agar, and if no fructifications were produced the mycelium covered the Petri dish in four weeks, whereas when these were developed the colony might be as little as $\frac{3}{10}$ in. in diameter in the same period. Concentric brown rings were formed in the medium and plentiful conidia were produced, especially on malt agar, budded off from any part of the mycelium. Mono-ascospore isolations yielded pycnidia identified as *Cytospora taxifolia* (Cke & Mass.) em. Pilát & Macal, though the author in adopting this name points out that the specimen labelled *C. taxifoliae* by Cooke in 1890 is not from *T. baccata* but from *Abies* and is identified as *C. friesii* Sacc. (1884), the pycnidial form of *Valsa*

friesii. The synonymy and a revised English diagnosis of *S. taxi* are given; the asci measure 57 to 75 by 10 to 13·5 μ and the spores (first uni-septate, later tri-, or in rare cases quinqueseptate) 20 to 37·5 by 6·5 to 9 μ (average 28 by 7·5 μ).

The fungus is stated to be widespread in Scotland, where it causes much damage to yew trees, particularly the golden varieties, in the course of a year or two. The spores infect the leaves of the new shoots in spring, but outward signs of infection appear only in early autumn. The stem may become ringed and the shoot die when several leaves close together are infected. Dead leaves remain on the shoot for at least six months, unless the tree is exposed to winds.

Material of *Physalospora gregaria* var. *foliorum* Sacc., the ascigerous stage of *Phyllostictina hysterella* (syn. *Phoma hysterella* Sacc. [*R.A.M.*, v, p. 198]), was collected in November, 1934. The ascospores grew slowly on yew extract agar forming a whitish-grey, later steel-grey, mycelium, with concentric zones of pycnidia. A revised English diagnosis is given of both stages. The club-shaped, eight-spored asci of *Physalospora gregaria* var. *foliorum* measure 52 to 90 by 13 to 25 μ, and the hyaline, unicellular, ovate-oblong to egg-shaped spores 15 to 23 by 7 to 12 μ; the spores of *Phyllostictina hysterella* are unicellular, hyaline, coarsely granular, 10 to 16 by 8 to 10 μ, and the straight, cylindrical sporophores 6·5 to 11 by 2·5 μ. The mycelium spreads through the stem and twigs of the yew trees, but if the lower part of the branch is killed the fungus does not spread into the upper part. The distribution of the fungus in Scotland appears to be limited. Other fungi recorded include *Gloeosporium taxi* and *Cryptocline taxicola* (syn. *G. taxicola*) [loc. cit.], the latter an obvious saprophyte.

Rohde [T.]. **Bedeutung der Schweizer Douglasienschütte für den Douglasienanbau.** [The importance of the Swiss needle-fall of Douglas Firs in Douglas Fir cultivation.]—*Z. PflKrankh.*, xlviii, 8, pp. 424–425, 1938.

This is a German version of the conclusions reached by the author and others on the needle-fall disease [*Phaeocryptopus gaeumanni*] of Douglas fir [*Pseudotsuga taxifolia*] already noticed from other sources [*R.A.M.*, xvii, pp. 494, 714].

Robertson (W. A.). **Report of the Director of Forest Products Research for the year 1937.**—*Rep. For. Prod. Res. Bd, Lond., 1937*, pp. 3–87, 9 pl., 2 figs., 6 graphs, 1938.

The following are among the items of interest occurring in this report [cf. *R.A.M.*, xvii, p. 362] apart from those already noticed from other sources. Extensive dry rot, usually due to *Coniophora cerebella* [*C. puteana*] and *Poria* spp., was found on a number of occasions in refrigerated ships [cf. ibid., xvii, p. 2], in which wooden linings are used and steel plates are fixed to wooden grounds, when the timber had become damp owing to condensation. In some new refrigerated vessels all the woodwork in the cold chambers is being treated under pressure with a water soluble preservative, as the ship is built.

Red stain (*Stereum sanguinolentum*) [see above, p. 26] was noted in spruce poles removed in thinnings from several plantations. *Fomes*

pinicola [see above, p. 2], comparatively rare in Great Britain, was twice isolated from trees affected with butt rot in Scotland.

In physiological studies it was found that cultures of Basidiomycetes occasionally ceased normal development, and presented a flat, sodden appearance suggestive of bacterial contamination, though no bacteria could be detected. These cultures seldom recovered, but their vigour was partly restored by frequent subculturing.

Laboratory tests showed that *Eucalyptus microcorys*, *Cedrus deodara*, and *Juniperus recurva* are very resistant to fungal decay, and that *Olea hochstetteri* is highly resistant to dry rot organisms. Resistance to fungal attack was much lower in *Quercus cerris* than in *Q. robur*.

CARTWRIGHT (K. ST. G.) & FINDLAY (W. P. K.). **Dry rot in wood.**—*Bull. For. Prod. Res., Lond.*, 1 (3rd Edition), 39 pp., 9 pl., 4 figs., 1938. 1*s.* 0*d.*

In the present and third edition of this bulletin [*R.A.M.*, xii, p. 669], the text has been thoroughly revised and the results of recent research work incorporated. The name *Poria vaillantii* is adopted in place of *P. vaporaria*. *P. xantha* [ibid., xvi, p. 6] is stated frequently to occur in greenhouse woodwork. *Trametes serialis* [ibid., xvii, p. 786; and above, p. 4] forms brown pockets of decay in timber of newly erected buildings, especially affecting Douglas fir [*Pseudotsuga taxifolia*] and other timbers imported from Canada and the United States in an unseasoned condition. The fungus ceases activity as soon as the wood is dried out.

PESCHEK (K.). **Holzschutz.** [Wood protection.]—*Öst. ChemZtg.*, xli, 16, pp. 299–305, 3 figs., 3 diags., 1938.

This is a comprehensive survey of the technique and practical application of some methods of timber preservation, embodying useful information on the fungi concerned in the destruction of wood, the estimated duration of life of poles and sleepers treated in various ways, and numerous other points of interest.

MAXSON (A. C.). **Root-rots of the Sugar Beet.**—*Proc. Amer. Soc. Sugar Beet Technol., 1938*, pp. 60–66, 1938. [Abs. in *Facts ab. Sug.*, xxxiii, 8, p. 36, 1938.]

At least eight major forms of root rot of sugar beets, exclusive of those affecting seedlings, may be distinguished [in the United States], namely, brown rot (*Rhizoctonia* [*Corticium*] *solani*) [see above, p. 5], dry rot (*R.* sp., possibly a strain of *C. solani*), red rot or root-killer (*R. crocorum*) [*Helicobasideum purpureum*: ibid., xvii, p. 368], *Fusarium* rot, brown rot, generally occurring in storage (*Phoma betae*) [ibid., xvii, p. 496], *Pythium* rot, sclerotial rot (*Sclerotium rolfsii*) [ibid., xvii, p. 643], and decay due to *Phytophthora drechsleri* [ibid., xv, p. 550]. To this list may be added a disease occurring in Texas and adjacent southern States, caused by the cotton root rot fungus, *Phymatotrichum omnivorum* [ibid., xvii, p. 674].

Pending the development of disease-resistant varieties the writer recommends seed disinfection for seed-borne disorders, applications of phosphate and boron, respectively, for black heart and heart and dry rot [ibid., xvii, p. 574], and rotation with small grains or maize

against the dry rot *Rhizoctonia*, for which potatoes, lucerne, sweet clover [*Melilotus alba*], beans [*Phaseolus vulgaris*], and garden truck may serve as hosts.

Cook (R. L.). **Boron deficiency in Michigan soils.**—*Proc. Soil Sci. Soc. Amer.*, ii, pp. 375–382, 1937. [Abs. in *Chem. Abstr.*, xxxii, 18, p. 7181, 1938.]

Boron deficiency in Michigan soils was associated either with heart rot or leaf injury of sugar beets. Lack of the trace element in lucerne [*R.A.M.*, xvi, p. 680; xvii, p. 344], red and alsike clovers [*Trifolium pratense* and *T. hybridum*], and sweet clover [*Melilotus alba*] is characterized chiefly by foliar reddening or yellowing. No damage to the crops resulted from applications of borax up to 80 lb. per acre.

Fourmont (R.). **Étude sur la désinfection des semences de Betteraves par le formol.** [Studies on the disinfection of Beet seeds with formalin.] —*Ann. Épiphyt.*, N.S., iv, 1, pp. 1–19, 7 figs., 2 graphs, 1938.

This is an expanded account of experiments on the control of *Phoma betae* already noticed from another source [*R.A.M.*, xvii, p. 285]. In inoculation experiments with *P. betae* infection of the seed-clusters did not succeed when they were steeped in, or sprayed with, suspensions of the fungus in sterilized water, but it was obtained by leaving the clusters in direct contact with young, vigorous cultures in Petri dishes for three days, and was most abundant when the seed-clusters were air-dry. A temperature of 10° to 12° was preferable to one of 20° to 25° [C.], and seedlings 3, 4, or 5 days old were the most readily infected. It is pointed out that the mycelium of the fungus, when established in the seed-clusters, permeates all the tissues, except three or four layers of sclerenchyma in the immediate vicinity of the seed, and is therefore difficult to kill by disinfectants. The disinfection of beet seeds is further complicated by the fact that germination may be adversely affected by strong antiseptics, such as sulphuric acid, even within a short time of action, owing to the permeability of the suture of the operculum covering the embryo.

Fife (J. M.). **Effect of sodium citrate on release of curly-top virus from aerobic precipitate of plant juice.**—*Phytopathology*, xxviii, 8, pp. 561–574, 6 graphs, 1938.

Sodium citrate was found to be very effective in releasing the sugar beet curly top virus [*R.A.M.*, xvii, p. 786] from alcoholic precipitates prepared from the juice of diseased sugar beets. The liquid was fed to non-viruliferous leafhoppers [*Eutettix tenellus*], and the usual procedure for inoculation followed, maximum infection (62 per cent. increase on the controls) resulting when the alcoholic precipitate was extracted with 6·8 mM. sodium citrate.

When the hydrogen-ion concentration of the extracted beet leaf juice containing the virus was increased below P_H 4·1 before precipitation with alcohol, a reduction in the amount of virus extracted by water was evident from the limited infection obtained. The virus was not, however, irreversibly inactivated at this hydrogen-ion concentration, or even at P_H 2·2, as extracts of the alcoholic precipitates with sodium

citrate caused infection comparable with that of former experiments. In another test the virus appeared to withstand brief exposures to a hydrogen-ion concentration approximate to P_H 1. The evidence suggests that the virus is fixed to other substances in such a manner that water is unable to release it from the precipitate.

Apparently, the same factors that fix or adsorb the virus in the juice from diseased beet leaves may also operate on the virus in juice from the tomato plant, the maximum percentage of infection with both plant juices being obtained after extraction of the precipitates with 6·8 mM. sodium citrate. Exposing the virus in the tomato plant juice to a hydrogen-ion concentration of P_H 4·1, however, had no effect on the amount subsequently released by water or sodium citrate.

It is suggested that these results may be explained on a basis of electrokinetic effects produced by the sodium citrate.

SEVERIN (H. H. P.). **Control of plant virus diseases in California.**—Abs. in *J. Bact.*, xxxvi, 3, pp. 289–290, 1938.

Curly top of sugar beets in California [see preceding abstract] may be combated by various methods, including adherence to a definite planting schedule to avoid coincidence between the development of the crop and the spring and autumn dispersal phases of the insect vector, *Eutettix tenellus*, and the cultivation of a resistant variety produced by the United States Department of Agriculture. Other lines of attack on the leafhopper are spraying and the destruction by summer hoeing, dragging, or disking of the alternate host (*Salsola kali-tenuifolia*), the ultimate elimination of which is envisaged by late autumn burning of the mature stands before the plants are torn loose and start rolling. Reference is also made to the control of western celery mosaic [ibid., xvi, p. 615; xvii, p. 798 and below p. 83] and peach mosaic [ibid., xvii, p. 798].

DECOUX (L.) & SIMON (M.). **L'influence de la jaunisse et de la pourriture du cœur sur la composition de la Betterave sucrière.** [The influence of yellows and heart rot on the composition of the Sugar-Beet.]—*Publ. Inst. belge Amélior. Better.*, vi, 4, pp. 265–270, 1938. [Flemish, German, and English summaries.]

The leaves of apparently healthy beets and beets affected with virus yellows [*R.A.M.*, xvii, p. 428] dug from the same field in Belgium on 7th September, 1937, contained, respectively, 0·61 and 0·54 per cent. total nitrogen (fresh material), the corresponding figures for the green (healthy) and yellow (diseased) areas of the leaves of individual plants dug a fortnight later being 0·64 and 0·38 per cent. The roots of the affected plants averaged about 40 per cent. more nitrogenous materials than those of the healthy beets.

The roots of beets affected with heart rot [ibid., xvi, p. 789; xvii, p. 643] showed 49·6 per cent. more nitrogen than those of healthy beets.

DECOUX (L.), VANDERWAEREN (J.), & ROLAND (G.). **La végétation de la Betterave en Belgique au cours de l'année 1937.** [The growth of the Beetroot in Belgium during the year 1937.]—*Publ. Inst. belge Amélior. Better.*, vi, 4, pp. 271–290, 1 graph, 1938. [Flemish, German, and English summaries.]

The following beet diseases were recorded in Belgium in 1937. Blackleg [associated with *Pythium de Baryanum*, *Corticium solani*, and *Phoma betae*: *R.A.M.*, xv, p. 764] was prevalent in Brabant and Flanders. Seed disinfection is not resorted to frequently enough by the local growers. *Cercospora* [*beticola*] and rust [*Uromyces betae*] caused little damage. Virus yellows [see preceding abstract] was general throughout the entire beet-growing area, especially in Flanders and Hainaut, where forage beets are widely grown for seed purposes and act as sources of infection for the vectors. Control [ibid., xv, p. 549] consists in the selection of healthy transplants, late sowing of transplants, the maintenance of a wide distance between the fields of transplants and other beet fields, the suppression of the vectors on the transplants and seed-bearers, early sowing of the beet fields, and the ploughing in of winter spinach before 1st April. A few cases of heart rot due to boron deficiency [see preceding abstract] and of symptoms resembling magnesium deficiency [ibid., xvi, p. 649] were also noted.

SINGALOVSKY (Z.). **Étude morphologique, cytologique et biologique du mildiou de la Betterave (Peronospora schachtii Fuckel).** [A morphological, cytological, and biological study of Beetroot mildew (*Peronospora schachtii* Fuckel).]—*Ann. Épiphyt.*, N.S., iii, 4, pp. 552–618, 40 figs., 7 graphs, 1937. [Received October, 1938.]

This detailed study of beet downy mildew (*Peronospora schachtii*) has already been noticed from another source [*R.A.M.*, xvii, p. 365].

OVINGE (A.). **Kwade harten-proeven in Zeeland in 1937.** [Marsh spot experiments in Zealand in 1937.]—*Tijdschr. PlZiekt.*, xliv, 4, pp. 208–213, 1938.

Further tests in Zealand, Holland, in 1937 demonstrated that for practical purposes marsh spot of Schokker peas [*R.A.M.*, xvi, p. 582] may be effectively combated by the application to the soil, just as the plants are about to flower, of 75 to 100 kg. per hect. manganese sulphate. Applications of 100 kg. slightly increased the yield in two plots (from 31 and 27 kg. per are to 32 and 28·5 kg., respectively) [as corrected by the author in *Tijdschr. PlZiekt.*, xliv, 5, p. 256, 1938]. Spraying with a solution of the compound (1 per mille) before flowering reduced the incidence of the disease by about half; no appreciable improvement was obtained by raising the strength up to 1 per cent., but excellent results were secured in tests involving three treatments (two before flowering and one after) with manganese sulphate at the strength of 1 per mille.

COOLEY (J. S.). **Susceptibility of crop plants and weeds to Sclerotium rolfsii.**—*Phytopathology*, xxviii, 8, pp. 594–595, 1938.

In the spring of 1937 pepper [*Capsicum annuum*], tomato, eggplant, cowpeas, Wilson soy-beans, navy beans [*Phaseolus vulgaris*], kidney beans [*P. vulgaris*], red clover [*Trifolium pratense*], mammoth clover [*T. medium*], alsike clover [*T. hybridum*], spring oats, and Korean lespedeza (*Lespedeza stipulacea*) were grown in a plot at the Horticultural Field Station, Beltsville, Maryland, in which, in 1935 and 1936, 20 per

cent. of the apple trees then growing there (subsequently removed) had been killed off by *Sclerotium rolfsii* [*R.A.M.*, xvi, p. 757]. The seed was planted or the plants set on 18th May. After about three weeks 1 out of 30 pepper plants, 1 kidney bean, and 2 cowpea plants out of several hundred were dead from the disease. After four weeks, 2 navy bean and 2 more cowpea plants were dead. On 29th July the disease showed no further advance on the beans or peppers, but the lespedeza showed about 20 per cent. infection. On 29th August more lespedeza plants had succumbed, but no further advance had occurred on the other plants. By the end of the season all the lespedeza plants were dead, except those in one 6-ft. section of a row. Neither the clover varieties nor the soy-beans became affected. Weeds showing infection were *Euphorbia preslii* and *Portulaca oleracea*, but even these were only slightly affected.

It would appear that climatic conditions in Maryland do not generally favour the disease, relatively few sclerotia surviving the winter. *L. stipulacea* may prove to be of use as an indicator crop, but should not be employed as a cover crop before planting susceptible plants.

British Honduras. Statutory Rules and Orders, Proclamation No. 10, 1938.—3 pp., 1938.

By this Proclamation, dated February 12th, 1938 [cf. *R.A.M.*, xi, p. 352], the importation of citrus species and coco-nuts and all parts of these plants is prohibited from all countries except in the case of importations made by the Department of Agriculture for scientific purposes. All fruits except green bananas, nuts, and processed fruits, and all vegetables except potatoes, onions, dried beans, peas, and grains, processed vegetables, and seeds are prohibited from importation from all countries except the United States, United Kingdom and Eire, and Canada, a certificate of introduction granted by the Agricultural Officer after inspection being required in the case of Jamaica. Tobacco seeds, cotton seeds and plants, and sugar-cane plants may be imported only under licence. Plants of banana and any other species of *Musa* from the West Indian Islands, Guatemala, Honduras, Nicaragua, Costa Rica, Panama, South America, Canary Islands, and West Africa may be imported under licence. For the importation of earth or soil and any living plants not specified above a certificate of introduction must be granted by the Agricultural Officer after inspection.

Service and regulatory announcements. April–June, 1938.—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 135, pp. 54–55, 1938.

The white pine blister rust (*Cronartium ribicola*) quarantine regulations restricting the inter-State movement of five-leaved pines in the United States [*R.A.M.*, xvi, p. 143] are withdrawn as from 1st July, 1938, except for 10 northern counties of California, 6 States in the west, and five States in the south-east, where the blister rust has not yet been found, since the rust has now become established in most of the commercially valuable pine-producing areas, and can, furthermore, spread naturally from pines to *Ribes* for a distance of over 150 miles.

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WADE (B. L.), ZAUMEYER (W. J.), & HARTER (L. L.). **Variety studies in relation to Fusarium wilt of Peas.**—*Circ. U.S. Dep. Agric.* 473, 27 pp., 10 graphs, 1 map, 1938.

In a study on the varietal resistance of peas to *Fusarium orthoceras* var. *pisi* [*R.A.M.*, xvii, p. 645] 547 strains of peas of American origin and 477 from the world-wide collection of D. N. Shoemaker were grown in 1931, and some additional strains in 1932–3, on heavily infested soil near Fairfield, Washington. It was found that in the Shoemaker collection of peas resistance was about five times as common as susceptibility. A list of all varieties tested with the percentages of wilt developed by their progenies is given. The samples (5 in number) from Ethiopia, where peas are believed to have originated, from Denmark (4), Venezuela (2), and Peru (1), 8 out of 10 of those from Italy, and 6 out of 7 of those from Canada were immune from wilt, whereas the samples from England (137) contained fewer immune varieties (50·4 per cent.) than those of any other country; samples from the United States (64), France (65), Holland (48), and the U.S.S.R. (42) showing 65·6, 67·7, 70·8, and 76·2 per cent. immunes, respectively. The resistance to wilt was not correlated with either size or colour of seed. The results for all varieties of the three years' field tests and a supplementary greenhouse test are tabulated and notes are given on a number of the varieties and their reaction to wilt. Nearly all the important American varieties of garden and canning peas were found to be susceptible, except Green and Yellow Admiral, Canada Field peas, Green Giant, Giant Stride, Horal (which is, however, not resistant to root rots), an American strain of Phenomenon, Prince of Wales, Profusion, Senator, Wisconsin Early Sweet, and most of the marrow varieties (large white or yellow type of field pea). The resistant biotypes found in susceptible varieties and the susceptible biotypes found in resistant ones were rarely typical of the variety in which found, except in the case of Alaska and World Record. Dwarf early market-garden varieties with short internodes and zigzag stems all proved to be completely susceptible, and no resistant rogues of any horticultural value were found. Several hypotheses are offered for the origin of susceptibility to wilt in peas; England, the centre of the world's pea-breeding, is stated to be free from pea wilt, so far as is known, and it is suggested that the gene for resistance is being lost in that country, or at least that the greatest number of varieties susceptible to wilt has been produced there. Both resistant and susceptible forms

of peas are believed to have originated rather early in the history of the pea. Most of the strains representing primitive types of peas were found to be resistant to wilt. The resistance factor was completely dominant in all crosses between many different types of pea, without any indication of modifying factors or more than one gene being involved.

ANDRUS (C. F.). **Seed transmission of Macrophomina phaseoli.**—*Phytopathology*, xxviii, 9, pp. 620–634, 4 figs., 1 graph, 1938.

A tabulated account is given of experiments in 1937 conclusively demonstrating the transmissibility of *Macrophomina phaseoli* by way of the seed in the Henderson Bush variety of Lima bean [*Phaseolus lunatus*] originating in Georgia. The incidence of infection approximated to 85 and 57 per cent. in non-sterilized and surface-sterilized seed, respectively, denoting the establishment of the fungus below the seed coat in over half the material. Seed sterilization before planting (three minutes in 1 in 1,000 mercuric chloride) reduced subsequent seedling infection by some 45 per cent.

The amount of seedling injury in plants produced by infected seed was found to be negatively correlated with the germination percentage. The effect of temperature on primary infection is not altogether clear, but apparently high temperatures in the pre-emergence phase promote rapid embryo development and reduce seed decay, whereas the same factor in the post-emergence stage is liable to favour the pathogen (with an optimum at 35° C.) more than the host.

The seedling phase is a type of damping-off, typical infection occurring on the cotyledonary node, and death of the seedling resulting when the fungus invades the stem before emergence from the soil. If invasion of the stem is delayed further, only incipient lesions are formed and the stems are not infected. Protracted high humidity was necessary to induce the secondary symptoms of ashy stem blight on older plants.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, xlix, 8, pp. 423–427, 5 figs., 1938.

White rot (*Sclerotium cepivorum*) [*R.A.M.*, xiv, p. 553; xvii, p. 717] is stated to have been recorded only four times in New South Wales, once on garlic [found in 1933] and three times on onions. While it is at present of minor importance locally, it is probably more widespread than the records indicate. To prevent further spread, bulbs and seedlings of onions and related crops grown elsewhere should not be planted unless known to be healthy. If infection appears in part of a crop, the affected plants should be burnt at once and the land not planted to onions or related crops for several years.

GIBBS (J. G.). **Onion-smut, Urocystis cepulae Frost.**—*N.Z. J. Sci. Tech.*, A, xx, 2, pp. 65–68, 1 fig., 1 diag., 1938.

Onion smut (*Urocystis cepulae*) [*R.A.M.*, xvi, pp. 296, 652] was observed for the first time in New Zealand in January, 1938, infection being apparently confined to an area of some 83 acres in the Marshlands district, near Christchurch. The fungus, which is believed to have been introduced on onions imported four or five years earlier for culinary purposes, caused up to 80 per cent. loss on one of the pro-

perties inspected. Directions are given for the control of the smut by the formalin drip method as described by Anderson and Osmun in the United States [ibid., ii, p. 460; iii, p. 184].

MILBRATH (D. G.) & RYAN (H. J.). **A method of control of western Celery mosaic.**—*Bull. Dep. Agric. Calif.*, xxvii, 3, pp. 290–295, 1938.

Some figures are quoted showing the beneficial effects of the observance of celery-free periods in the Venice district of California in the control of western celery mosaic [*R.A.M.*, p. 78]. The system has been practised, at first on a voluntary basis and later under a special provision of the Agricultural Code, since 1934, when the yield of half-crates per acre sank to 311 from an area of 900 acres compared with 1,026 from 700 in 1930. By 1937 the yield had once more risen to 847 half-crates per acre over an area of 950 acres, accompanied by a corresponding improvement in the quality of the product. The celery-free period now extends from 16th September to 16th October and 11th December in the glasshouse and field, respectively.

RÖDER (K.) & SCHULTZ (H.). **Petersilie, eine neue Wirtspflanze von Erysiphe umbelliferarum De Bary.** [Parsley, a new host plant of *Erysiphe umbelliferarum* de Bary.]—*Zbl. Bakt.*, Abt. 2, xcix, 1–4, pp. 60–63, 2 figs., 1938.

The authors record the occurrence during the autumn of 1937 of a powdery mildew, morphologically identical with *Erysiphe umbelliferarum*, on two smooth-leaved varieties of parsley in the vicinity of Berlin. When naturally infected plants were transferred to the greenhouse under high moisture conditions the disease spread among healthy plants of the same varieties very rapidly and was very destructive, but curly-leaved varieties and several varieties of celery remained completely immune, even when artificially infected with spore suspensions of the fungus. This is considered to indicate a high degree of specialization of the *E. umbelliferarum* strain found on the smooth-leaved parsley varieties.

BERGER (G.). **Contribution à la connaissance de Leveillula taurica Arnaud.** [Contribution to the knowledge of *Leveillula taurica* Arnaud.]—*Ann. Épiphyt.*, N.S., iv, 1, pp. 21–25, 2 figs., 1938.

The author states that *Leveillula* [*Oidiopsis*] *taurica* [*R.A.M.*, xvii, p. 15], a long-established parasite of the globe artichoke (*Cynara scolymus*) in French Morocco, was found in the autumn of 1936 in the whole of the Chaouïa region also attacking the cardoon (*C. cardunculus*), nasturtium (*Tropaeolum majus*) [ibid., xvii, p. 461], an ornamental *Oxalis* with pink flowers, *Asclepias* sp., chillies (*Capsicum annuum*), and several varieties of tomato and eggplant [ibid., xviii, p. 11]. At the end of 1937 it was also recorded on *Ampelopsis* sp., a new host plant for the fungus. Observations indicated that tomato plants badly attacked by it bore practically no fruit, and unless controlled the disease may eventually prove as dangerous in French Morocco to its other hosts as to the globe artichoke.

HASHIOKA (Y.). **Specialization in Sphaerotheca fuliginea (Schlecht.) Poll.**—*Ann. phytopath. Soc. Japan*, viii, 2, pp. 113–123, 1 fig., 1938. [Japanese, with English summary.]

Studies on the morphological characters of the conidia of *Sphaerotheca* [*humuli* var.] *fuliginea* [*R.A.M.*, xvii, p. 579], parasitic on various plants in Formosa, and inoculation experiments with the fungus disclosed the existence of the six distinct physiologic races as indicated in the following key: A. Conidia with an average length of 29 μ; race 1 parasitic on *Impatiens balsamina*. B. Conidia with an average length of 32 μ and (*a*) with a width of 18 μ; race 2 on Cucurbitaceae and race 3 on *Lactuca indica* var. *dracoglossa* and related species; (*b*) width of 20 μ; race 4 on eggplant and 5 on *Hibiscus mutabilis*. C. Conidia with an average length of 36 μ; race 6 on *Emilia sonchifolia*.

DANA (B. F.). **Resistance and susceptibility to curly top in varieties of Squash, Cucurbita maxima.**—*Phytopathology*, xxviii, 9, pp. 649–656, 1 fig., 1938.

Two strains of squash (*Cucurbita maxima*), Umatilla Marblehead and Yakima Marblehead, have shown a general marked resistance to the beet curly top virus [*R.A.M.*, xiv, p. 339] in Oregon, where a number of other varieties, e.g., Banana, Boston Marrow, and Blue and Golden Hubbard, tested during the period from 1928 to 1937, evinced a high degree of susceptibility. The two Marbleheads are heterozygous for resistance, a few plants within each strain showing pronounced liability to curly-top injury. In the case of susceptible varieties, seedlings inoculated by viruliferous leafhoppers (*Eutettix tenellus*) immediately on emergence from the soil may die before the true leaves appear, while the new growth of older plants is definitely dwarfed, the internodes shortened, and the leaf blades develop a savoyed surface or upward marginal rolling. An upward bending of the runner tip is another marked characteristic of curly top. The blossoms on diseased shoots usually fail to set fruit. On the resistant Marbleheads a witches' broom-like habit of growth is apt to follow infection, sometimes accompanied by phyllody of the petals and pistil of pistillate flowers. The foliage is stunted and abnormally pale, while the leaf blades of the younger foliage roll upwards and are unusually rigid.

YOUNKIN (S. G.). **Pythium irregulare and damping off of Watermelons.**—*Phytopathology*, xxviii, 8, p. 596, 1938.

In the spring of 1937 in Iowa 15 isolations were made from field-grown seedlings of watermelons resistant to wilt (*Fusarium bulbigenum* var. *niveum*) [*R.A.M.*, xvii, p. 371] showing wilted cotyledons, water-soaked hypocotyls, and, occasionally, parasitized roots, and of these fungi 13 were species of *Pythium*, 11 being tentatively assigned to *P. irregulare* [ibid., xi, p. 330; xiv, p. 240]. Surface-disinfected seeds of the wilt-resistant Improved Stone Mountain No. 5 and wilt-susceptible Dixie Queen watermelon varieties were then planted in the greenhouse in soil artificially infected with *P. irregulare* and kept at about 20° C. It was found that the fungus caused seed decay, pre-emergence and post-emergence damping-off, and root necrosis in both varieties.

The average stand of the wilt-resistant and wilt-susceptible seedlings 30 days after planting was 37·3 and 40·3 per cent., respectively, as compared with 93·8 and 97·2 per cent. for the same varieties in autoclaved soil. The fungus was repeatedly isolated from infected roots, hypocotyls, and cotyledons of the plants in the infected soil, and from ungerminated seed in the same soil. *F. bulbigenum* var. *niveum* and *P. irregulare* produced similar damping-off symptoms under controlled conditions. It is believed that seedling losses under field conditions may partly be due to the latter organism.

JAGGER (I. C.), WHITAKER (T. W.), & PORTER (D. R.). **A new biologic form of powdery mildew on Muskmelons in the Imperial Valley of California.**—*Plant Dis. Reptr*, xxii, 13, pp. 275–276, 1938. [Mimeographed.]

In the middle of the season of 1938 a considerable degree of infection by powdery mildew (*Erysiphe cichoracearum*) was observed to have recently developed on the hitherto resistant No. 45 cantaloupe melon in the Imperial Valley, California [*R.A.M.*, xvii, p. 157]. Later, all the fields of this variety became affected, and several pure-line selections of No. 45 were also attacked in breeding plots.

In carefully checked parallel inoculation experiments on excised leaves, using mildew from No. 45 and from a non-resistant variety in a field where the surrounding No. 45 melons appeared to be unaffected, the mildew collected from the non-resistant variety (race No. 1) did not develop on the leaves of No. 45, though it abundantly infected the leaves of non-resistant varieties, while race No. 2, collected from No. 45 melons, developed equally abundantly on the leaves of No. 45 and those of non-resistant varieties. Similar inoculations of seedlings in flats confirmed these results.

It would appear to be certain that a new race of *E. cichoracearum* has appeared on No. 45 cantaloupe melons in the Imperial Valley. In marked contrast to the non-resistant varieties, No. 45 showed little or no defoliation or commercial loss. In the somewhat extensive cantaloupe stocks grown locally for breeding purposes a few strains appeared to be highly resistant to both races.

MARCHIONATTO (J. B.). **Researches on the Pepper diseases at Salta and Jujuy.**—*Int. Bull. Pl. Prot.*, xii, 8, pp. 169–170, 1938.

The author states that *Phytophthora capsici* [*R.A.M.*, xvi, p. 833; xvii, p. 301] was observed for the first time in the north of the Argentine in October, 1937, attacking chillies [*Capsicum annuum*] in the regions of Salta and Jujuy, since when it has been shown to be spreading over a wide area, destroying the young plants in certain localities and adult plants in others. The blight is greatly favoured by excessive moisture and is extremely virulent where peppers are cultivated after the first rains in January.

LUTHRA (J. C.), SATTAR (A.), & BEDI (K. S.). **The control of the blight disease of Gram by resistant types.**—*Curr. Sci.*, vii, 2, pp. 45–47, 1 fig., 1938.

In further work carried out in the Punjab on gram (*Cicer arietinum*)

blight (*Ascochyta rabiei*) [*R.A.M.*, xv, pp. 198, 700; xvii, p. 501] 187 types of gram obtained from America, Europe, and different parts of India were tested for resistance by spraying with an aqueous suspension of the pycnospores or spreading diseased gram debris over the plants. The only types that showed resistance were Nos. 281, 199, 4 F 32 (all very resistant), and 180 (fairly resistant), all of which originated from France but were supplied by the Bureau of Plant Industry, Washington. The type selected to replace the local seed was 4 F 32, renamed for purposes of convenience F 8. It is expected that in 1940 about 25,000 maunds of seed of this type will be available to the local growers.

Iwata (Y.). **Studies on the penetration phenomena in Pseudoperonospora cubensis Berk. et Curt.**—*Ann. phytopath. Soc. Japan*, viii, 2, pp. 124–144, 6 figs., 1938. [Japanese, with English summary.]

In studies on the mode of penetration of *Pseudoperonospora cubensis* [*R.A.M.*, xvii, p. 300] into the cucumber and other non-susceptible plants, a large number of zoospores were frequently observed to encyst on the surface of hanging drop cultures and to produce erect germ-tubes from the cyst. Zoospores in a hanging drop on the lower surface of a cucumber leaf often swim along the boundary line of the epidermal cells, frequently dashing against it, presumably in response to the diffusion of a stimulus from the epidermis. On the cucumber leaf cysts are formed on the stomata and epidermal cell boundary line, those on the former sending out a penetrating hypha into the stomatal aperture and forming a vesicle in the substomatal cavity, from which an infection hypha enters a parenchyma cell and forms a haustorium. The slender hypha extruded from a cyst on the epidermal cell boundary occasionally succeeds in penetrating a stoma. Stomatal penetration occurs on the cotyledons, but not on petioles, stems, or hypocotyls.

Inoculation experiments on 73 species of phanerogamic plants in 32 families gave positive results as regards stomatal penetration in 49 dicotyledonous plants of 22 families, including (besides a number of Cucurbitaceae) *Humulus japonicus*, buckwheat, beet (*Beta vulgaris* var. *rapacea*), *Paeonia albiflora* var. *trichocarpa*, *Brassica pekinensis*, *B. chinensis* var. *oleifera*, radish, *Phaseolus lunatus*, broad bean, *Impatiens balsamina*, *Ampelopsis* [*Vitis*] *heterophylla*, cotton, sweet potato, tomato, eggplant, *Solanum nigrum*, *Dahlia variabilis*, and *Zinnia elegans*.

On the upper surface of the epidermis stripped from the cucumber leaf, zoospore encystment and penetration are effected in the same way as on the intact leaf. On the lower surface of cucumber leaves killed by boiling water penetration occasionally takes place both through the epidermal cell boundary line and stomata, but the hyphae rapidly degenerate.

Branas (J.). **Chronique. Encore le court-noué.** [Current notes. Court-noué again.]—*Progr. agric. vitic.*, cx, 32, pp. 115–117, 1938.

The author states that he and his co-workers apply the term 'vine degeneration' to a series of symptoms which become progressively more serious as they appear in the forms of Reisigkrankheit, court-noué,

'anthracnose déformant', Petri's 'arriciamento' and 'roncet', as found in Sicily [*R.A.M.*, xv, p. 630; xvii, pp. 222, 793]. The degeneration disease known under these different names, and attributed to a virus, has nothing whatever in common with the bacterial disease known as the 'disease of the island of Oléron', or the bacterial diseases known as 'chabot' in Champagne, 'roncet' in Burgundy, and 'aubernage' in Yonne, or with the allegedly bacterial disease known as 'mal nero' [ibid., xvi, p. 587], while it is doubtful whether so-called bacillary gummosis [cf. ibid., xvi, p. 229] really exists at all. Low temperatures in spring may induce a non-hereditary condition the symptoms of which partly resemble those of court-noué [cf. ibid., ix, p. 578], but true court-noué is never induced by soil or climatic factors or by the plant itself: it is not a symptom of physiological weakness, although its symptoms are aggravated by such weakness.

VOBORIL (F.). **Zum starken Auftreten von Chlorose in den Weinbaugebieten des Gaues Niederdonau.** [On the prevalence of chlorosis in the viticultural districts of the Lower Danube province.]—Reprinted from *Weinland, 1938*, 8/2, 1 p., 1938.

Two types of chlorosis, one lime-induced and the other (and more serious) due to unknown pathogenic agents, are stated to have assumed exceptionally virulent forms, mostly on Riparia stocks, in the vineyards of the Lower Danube valley, Austria, during the last eight years. The parasitic form of the disturbance should properly be termed 'bleaching', the lower leaves being of a dull, leaden appearance, the shoots of unequal length with a profusion of suckers, the internodes irregularly shortened towards the branch tips, and the upper leaves becoming progressively smaller and shrivelling. In the second year from the inception of the disease the affected vines die off.

OSTERWALDER (A.). **Prüfung einiger Peronospora-Bekämpfungsmittel.** [Testing of some preparations for *Peronospora* control.]—*Schweiz. Z. Obst- u. Weinb.*, xlvii, 10, pp. 192–194, 1938.

Good control of *Peronospora* [*Plasmopara viticola*] on 170 Räuschling vines was obtained in trials at the Wädenswil (Switzerland) Experiment Station in 1937 by six applications (31st May, 12th and 22nd June, 5th and 19th July, and 2nd August) of Bordo-Xex [*R.A.M.*, xv, p. 588] (1·5 per cent. for the early treatments, 2 per cent. later), 2 per cent. virikupfer [viricuivre: ibid., xvi, p. 152; xvii, p. 375] (16 per cent. copper), and cupromaag (0·5, later 1 per cent.), all from Chem. Fabrik Dr. Maag, Dielsdorf. Cupryl and Kupferstaub Schering were less satisfactory, and, indeed, none of the preparations tested proved quite as effective as the standard 1·5 to 2 per cent. Bordeaux mixture.

Plantesygdomme i Danmark 1937. Oversigt, samlet ved Statens plantepatologiske Forsøg. [Plant diseases in Denmark in 1937. Survey of data collected by the State Phytopathological Experiment Station.]—*Tidsskr. Planteavl*, xliii, 2, pp. 222–278, 2 figs., 2 graphs, 1938. [English summary.]

This report, prepared on the usual lines [cf. *R.A.M.*, xvii, p. 13], contains the following among other items of interest. Reclamation

disease of wheat [ibid., xvii, p. 508], associated with copper deficiency, developed over an area in which the acid subsoil had been ploughed up to counteract manganese deficiency (grey speck) [ibid., xvii, p. 586], the latter being very prevalent in winter wheat, and still more so in rye. *Puccinia graminis*, of rare occurrence in Denmark during the last 20 years, was widespread on wheat, oats, and barley, causing losses of up to 500 kg. per hect. in the first-named crop. A number of barberries were detected and eradicated in connexion with this exceptional outbreak [ibid., ix, p. 98].

Wart disease (*Synchytrium endobioticum*) was reported from six new administrative areas [ibid., xvii, p. 13]. *Rhizoctonia* [*Corticium*] *solani* was more virulent than at any time during the past four or five years, destroying entire plots of potatoes. Infection of potatoes by *Colletotrichum atramentarium* [ibid., xvii, p. 60], new to the country, was apparently promoted by potassium deficiency. *Monilia* [*Oospora*] *fimicola*, a source of heavy losses in mushroom [*Psalliota* spp.] beds in 1936 [ibid., xvii, pp. 13, 792], was successfully combated in 1937 by appropriate cultural methods, including early transference of the compost to the houses, allowing it to warm up gradually, and burning sulphur at the maximum temperature of 55° C.

Many plum and myrobalan [*Prunus divaricata*] trees were killed by *Pseudomonas mors-prunorum* [ibid., xvii, p. 13 and below, p. 122], which also attacked sweet cherries in some localities. *Plasmopara viticola*, ordinarily a rarity in Denmark, was reported from several places.

A wilt of five- to six-year-old elms in a large cemetery near Copenhagen, first observed in 1935–6, was shown by isolation tests to be due to *Verticillium albo-atrum* [ibid., xvi, p. 353], from which, however, the trees were already recovering in 1937.

Slight damage to flax was caused by *Polyspora lini* [ibid., xv, p. 652; xvii, p. 396], a new record for Denmark.

THOMAS (K. M.). **Detailed administration Report of the Government Mycologist, Madras, for the year 1937–38.**—21 pp., 2 graphs, 1938.

In pot tests the application of ammonium sulphate and sodium nitrate at rates equivalent to 40, 80, 160, and 240 lb. of nitrogen per acre increased infection by *Piricularia oryzae* [*R.A.M.*, xvii, pp. 14, 836] in susceptible varieties of rice. For equal amounts of nitrogen, sodium nitrate induced greater susceptibility than ammonium sulphate. The most resistant variety tested, Co. 4, remained unaffected by heavy doses of nitrogen. When 20 rice varieties were sown at monthly intervals from August to December, the highest infection occurred in the August sowings, but even in these the varieties 10,998, Co. 11, Adt 6, and Co. 4 remained completely resistant. In any one variety, the late sown suffered less than the early sown crops, the difference being attributed to more frequent rain, more numerous cloudy days, and increased relative humidity during the early period.

The use of ceresan as a seed treatment against rice foot rot (*Fusarium moniliforme* var. *majus*) [*Gibberella fujikuroi*: ibid., xvii, p. 14] is gaining ground in Coimbatore.

Nigrospora oryzae was found on several occasions on rice [ibid., xvi,

p. 490], but repeated inoculations with pure cultures of the fungus were negative.

The incidence of red gram [*Vigna unguiculata*] wilt (*Fusarium vasinfectum*) steadily increased from the fifth week after emergence, reached a peak between the thirteenth and fifteenth weeks, this period coinciding with flowering and pod formation, and then declined. The fungus spreads about two-thirds of the distance up the stem, but does not affect the pods. Infected soil invariably gave rise to infection, whereas sterilized soil did not. A comparative study of the cotton and red gram wilt organisms showed them to be morphologically and physiologically different strains of *F. vasinfectum*. The cotton strain did not infect red gram, and vice versa. A third strain of *F. vasinfectum* was found on chilli pepper [*Capsicum annuum*], the crop being considerably damaged after flowering.

Analysis of the data obtained in extensive field experiments on the control of koleroga disease (*Phytophthora arecae*) [ibid., xvii, pp. 14, 295, 625] of areca palm showed that Bordeaux mixture 1 and 2 per cent. gave, respectively, 13 and 5·1 per cent. infection, one and two applications of Bordeaux mixture gave 14·9 and 4·3 per cent. infection, respectively, while the addition of vegetable oils and casein as spreaders to the Bordeaux mixture was more effective than resin.

The *Gloeosporium* disease of areca inflorescences and nuts in South Kanara [ibid., xvii, p. 14] was also found in parts of the Coimbatore district. The symptoms consist in spotting of the leaves, leaf sheaths, peduncles, and pedicels, shedding of the flowers and tender nuts, and partial withering of the branches. Acervuli develop profusely on the surface of tender nuts and stalks. Two gardens showed, respectively, 42 and 59 per cent. infection of the bunches. Inoculation tests demonstrated that the fungus was parasitic on tender areca and coco-nut inflorescences.

Laboratory studies with the horse gram [*Dolichos biflorus*] wilt organism (*Macrophomina phaseoli*) [loc. cit.] showed that it grew at P_H 3·04 to 7·97, the optimum value being P_H 5·17 to 8·04. The P_H value in the nutrient media shifted from acid to alkaline and vice versa to a point near P_H 7. The thermal death point was between 55° and 56° C. at 10 minutes' exposure. Pycnidia of *M. phaseoli* developed in cultures on several solid media and Leonian's pycnidial medium. *Trichoderma lignorum* inhibited the growth of the fungus.

Cardamom (*Amomum subulatum*) was affected by a mosaic mottling of the leaves and tender shoots, apparently due to a virus. The disease is spread by planting infected rhizomes, but it is not seed-borne. A species of *Cephalosporium* was isolated from rhizomes showing the rot disease, and was shown by inoculation tests to cause a soft rot of tender rhizomes.

Ginger soft rot (*Pythium butleri*) [cf. ibid., xvii, p. 294], for which no reliable control measures are at present known, is a menace to the industry on the west coast, where about 18,000 acres are planted to ginger. The oospores of the fungus were found on the scales of preserved seed rhizomes, which, under certain circumstances, became attacked during storage.

In varietal resistance trials the sugar-cane varieties Co. 205 and Co.

335 showed no mosaic from 1933 to 1938, inclusive, while Co. 355 and P.O.J. 2878 showed none during the four seasons when they were tested.

A new disease of brinjal [eggplant] was characterized by a reduction in leaf size, alteration in leaf shape and texture, shortening of the nodes, the absence of flowers, and sterility. No causal organism was found, and the condition may be due to a virus. The disease was not sap-transmissible, but was transferred by grafting to eggplant and *Datura fastuosa*, the first symptoms appearing 21 days after grafting. The older leaves of the grafted plant remained normal, while the new growths became characteristically affected.

Tobacco in the Coimbatore and Salem districts was affected by mosaic, ring spot, and leaf curl. Transmission experiments indicated that a number of strains of mosaic may be present locally. The leaf curl resembles kroepoek [ibid., xvii, p. 75] and was transmissible by grafting.

Surveys showed that black, brown, and yellow rusts of wheat [*Puccinia graminis*, *P. triticina*, and *P. glumarum*, respectively] and barley dwarf rust [*P. anomala*] are present in the Nilgiri hills throughout the year, but only wheat brown rust in the Palni hills.

A disease of clove trees, characterized by splitting and flaking of the bark, was associated with a species of *Ganoderma*, the fructifications of which appeared on the dead wood and branches.

NATTRASS (R. M.). **Annual report of the Plant Pathologist for the year 1937.**—*Rep. Dir. Agric. Cyprus, 1937*, pp. 48–50, 1938.

The following are among the items of interest in this report [cf. *R.A.M.*, xvii, p. 15] in addition to those already recorded from other sources. Batches of *Triticum durum* seed from Syria, with spontaneous heavy contamination by *Tilletia caries*, were treated with copper carbonate and a proprietary mercurial dust, which reduced the incidence of infection from 23·7 to 6·9 and 6·8 per cent., respectively. In continued trials of imported wheats for rust reaction, Pusa and Geeralying remained entirely free from *Puccinia graminis*, while Ford, Dundee, and Nabawa were only mildly attacked, the two last-named, however, being highly susceptible to *P. glumarum*: all varieties were slightly infected by *P. triticina*.

A number of young and mature apple trees on poorly drained sites in the Peradpedhi district were killed by *Rosellinia necatrix* [ibid., xvi, p. 688]. Black spot [scab] (*Fusicladium dendriticum*) [*Venturia inaequalis*], previously of little importance in Cyprus, severely attacked the fruit in the same region. Heavy infection of peaches by powdery mildew (*Sphaerotheca pannosa*) [ibid., xvii, p. 693] resulted in distortion of the ripe fruit.

In a seed potato disinfection experiment, conducted in co-operation with A. E. Muskett and W. J. Megaw, the test material consisted of three lots, (A) and (B) severely infected by powdery and common scab [*Spongospora subterranea* and *Actinomyces scabies*], respectively, and (C) commercially clean tubers, practically free from both diseases. Of each lot, one-third was treated in Northern Ireland before shipment, one-third disinfected on arrival in Cyprus with 0·5 per cent. aretan [ibid., xvii, p. 835], and one-third planted without treatment. Little

or no wastage developed in any of the lots during the period of transit from 5th December, 1936, to 4th January, 1937. The following results were obtained. No powdery scab appeared on any tubers from the resulting crop. Disinfection in Northern Ireland and in Cyprus reduced the incidence of common scab in lot A from 1·72 to 0·23 and 0·08 per cent., respectively; in lot B from 10·72 to 0·32 and 0·30, respectively; in lot C from 9·88 to 0·084 and 0·068 per cent., respectively. It is apparent from these figures that the extent of common scab infection on the seed does not appreciably influence the future course of the disease on non-infested soil, and also that the efficacy of the home and Cyprus treatments did not materially differ.

Vines in most districts and at all altitudes were attacked by *Cercospora roesleri* [ibid., xvi, p. 493].

Phomopsis [*Diaporthe*] *citri* and *Phytophthora citrophthora* were responsible, respectively, for lemon and orange rots. Exanthema of lemon and orange twigs [ibid., xvii, pp. 16, 656] and endoxerosis [internal decline] of the fruits [ibid., xvi, p. 313] were observed at Famagusta, while mottle leaf [see below, p. 103] was present in the same district and Morphou.

Local cowpea varieties suffered from rust (*Uromyces vignae*), which did not, however, attack the resistant [American] Iron and Brabham [ibid., xiv, p. 742].

The following new records were made during 1937: *Stagonospora iridis* on *Iris florentina* and *Cercospora rosae* on rose [ibid., xvii, pp. 506, 753].

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, xlix, 9, pp. 487–490, 4 figs., 1938.

The following items may be noticed in this series of notes. Bacterial blight (*Bacterium juglandis*) is stated to be a major disease of walnuts [*R.A.M.*, xvii, p. 420] in New South Wales. It is carried over through the winter chiefly in diseased buds, and is spread mainly by rain splashes. In grafted stock the spray applications may be given to all trees at one operation, but seedling trees must be 'spot'-sprayed as they reach the appropriate stage of blossom development in order to secure protection and to avoid the pollination difficulties that occur if the trees are sprayed at incorrect blossom stages. The first spray application is made in the spring when the buds are expanding, young leaves are forming, and the catkins are almost fully expanded, but before most of the pistillate flowers have come into full bloom. The second application is made immediately after most of the nut-bearing flowers have been pollinated.

For some years the Biological Branch has used small cereal grain as a basis for the culture of mushroom spawn and while it has proved very satisfactory in many respects, uniformly good results are more likely to be secured from compost spawn, since certain types of fungal contamination are more difficult to detect in grain spawn than in compost spawn, and furthermore grain spawn is very attractive to mice.

Parham (B. E. V.). **Central Agricultural Division. Annual report for 1937.**—*Annu. Bull. Dep. Agric. Fiji*, pp. 37–49, 1938.

During 1937, shirlan AG gave very satisfactory control of the banana

leaf-spotting organisms *Cercospora musae*, *Uromyces musae*, and *Cordana* [*Scolecotrichum*] *musae* in Fiji [*R.A.M.*, xvii, pp. 331, 760], particularly in one plot of Gros Michel. Very promising results were also given in a plot of Veimama bananas by spraying with Bordeaux mixture (4–5–40).

The imported banana varieties I.C. 2. and Lacatan showed severe infection by bunchy top [loc. cit.] in the field, while many Gros Michel plants were also affected in Koro Island and Tailevu Province. Although the Veimama variety is apparently tolerant to bunchy top, it showed 5 to 30 per cent. infection in the field.

Immature bunches of Blue Java bananas were completely destroyed as a result of early infection by *Gloeosporium musarum* [ibid., xviii, p. 41], the fruits shrivelling up and becoming mummified.

A bacterial infection, probably *Bacterium maculicola*, caused loss of maturing cauliflower [ibid., xv, p. 696] heads and leaves in a dry locality. A condition resembling 'whiptail' [ibid., xiii, p. 344], in which no heads were formed, was common in cauliflower plots.

LARTER (L. N. H.). **Plant pathology.**—*Rep. Dep. Sci. & Agric. Jamaica, 1937*, pp. 77–78, 1938.

During the early part of 1937 (the driest period of the year), banana leaf spot (*Cercospora musae*) [*R.A.M.*, xvii, p. 375 and preceding abstract] became less severe in Jamaica, at least in its more serious form, but by the beginning of August, while only a few areas of intense infection were noticeable, marked spread had occurred of the mild form round the severely affected areas, especially in fields of young plants. By the middle of October, after a period of rains, infection had become widespread, though confined to areas where outbreaks had occurred in 1936. In irrigated areas in the south, where planters were endeavouring to spray regularly, infection became worse owing to interruption of the spraying schedule by rain. In localities where water was available and topography permitted, spraying with Bordeaux mixture was advised, but on hillsides where marketable fruit was being grown, growers were recommended to use copper sulphate-lime dust. On exposed denuded ridges where infection was severe, and where under normal conditions the fruit produced was poor, growers were advised to destroy the affected plants.

Among various other diseases observed during the year were storage rot of potatoes (*Fusarium oxysporum*) and *Helminthosporium sacchari* [ibid., xvi, p. 206] on sugar-cane.

ROMBOUTS (J. E.). **Moléstias criptogamicas do Cacauiero : resumo da literatura mundial e observações na zona cacauiera da Baía.** [Cryptogamic diseases of Cacao: a summary of the world literature and observations in the Cacao-producing region of Bahia.]—*Bol. Minist. Agric., Rio de J.*, xxvi, 10–12, pp. 33–57, 1937. [Received August, 1938.]

An annotated list, supplemented by a three-page bibliography, is given of the diseases affecting the cacao crop in all the countries where it is grown, the following having been observed in Bahia, Brazil: *Phytophthora palmivora*, '*Calonectria bahiensis* Hempel' (*Bol. Agric.*,

S. Paulo, 1904), *Corticium* (?) *lilaco-fuscum*, *C. salmonicolor*, *C. stevensii* [*R.A.M.*, xiv, p. 795], (?) *Armillaria mellea*, and *Botryodiplodia theobromae*.

PORTER (R. H.), HENDERSHOTT (W. E.), & DAVIS (G. N.). **Indexing farmers' seed lots for seed-borne organisms and response to seed disinfectants.**—*Res. Bull. Ia agric. Exp. Sta.* 238, pp. 243–272, 1938.

The [tabulated] results obtained from laboratory and field germination tests carried out in Iowa from 1932 to 1936, inclusive, demonstrated that detection of *Gibberella saubinetii* and related species of *Fusarium*, and of *Helminthosporium sativum* and other species of this genus on seed samples of barley, oats, and wheat, mostly received from farmers, was possible in the laboratory when the seedlings were germinated on moist blotters at 20° C. [cf. *R.A.M.*, xvi, p. 444]. The development of blight on seedlings grown in a mixture of autoclaved soil and sand demonstrated the presence in the seed of *G. saubinetii* and *F.* spp. The organisms causing dry rot of maize, chiefly *Diplodia zeae*, *G. saubinetii*, and *F.* spp. were found on seedlings grown on moist blotters at 24° to 27°. *Basisporium gallarum* [*Nigrospora* sp.] was more readily detected by examination of ungerminated, heavily diseased seed. The presence of the various seed-borne organisms on the seeds of barley, maize, oats, and wheat generally resulted in blighted seedlings and reduced germination.

Treatment of infected seed of barley, maize, oats, and wheat with organic mercury compounds gave almost complete control of seedling blights in the laboratory and, in nearly all cases, gave significant increases in germination both in the laboratory and the field. Samples that benefited most in the laboratory, benefited most in the field also. The effect of seed treatment on flax seed germination was similar to that on small grains in so far as the number of normal seedlings was concerned.

A satisfactory dust for laboratory purposes was obtained by diluting 5 per cent. ethyl mercury phosphate to a 1 per cent. content by the addition of French talc, button dust, or gypsum, the effect of the diluted dusts being similar both in laboratory and field tests. Used alone, the fillers increased the germination and yield of barley, but less than when combined with the mercury compound. Ethyl mercury phosphate and ethyl mercury chloride controlled the development of species of *Aspergillus*, *Macrosporium*, *Mucor*, *Penicillium*, and *Rhizopus* on seeds tested on blotters.

On the whole, the difference in yield from treated and untreated barley, maize, and oats seed was significantly in favour of the treated seed, the greater increases occurring in lots infected with seed-borne fungi. Germination of barley, maize, flax, oats, and wheat seed was generally lower in the field than in the laboratory, but the relative position of a sample in the laboratory was generally maintained in the field. In seasons of insufficient rain, field germination does not provide an adequate indication of seed viability, seed laboratory tests being more reliable for this purpose.

Blair (I. D.). **Seed-disinfection trials with cereals.**—*N.Z. J. Sci. Tech.*, A, xx, 2, pp. 128–132, 1938.

A tabulated account is given of recent experiments at the Canterbury Agricultural College, New Zealand, in cereal seed-grain disinfection with agrosan G (agrosan, 1936 type), ceresan U.T. 1875, and two experimental grades of dust containing a higher percentage of mercury. In ordinary field soil the preparations exerted no significant effect on the germination and yield of Garton and Algerian oats and Tuscan wheat, though there was a general tendency towards an increase in both in the treated seed. Where the dusted wheat was sown in soil heavily inoculated with *Fusarium culmorum*, all the treatments significantly increased the amount of field germination, the largest increase of 12·4 per cent. over the control being given by one of the experimental mercury dusts at the rate of $\frac{1}{4}$ oz. per bush. Correspondingly substantial increases of yield were obtained in most of the treated plots, the maximum of 30·2 per cent. being given by the ceresan. Although wheat bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*] may be well under control in New Zealand as a result of seed-grain disinfection [*R.A.M.*, xvii, pp. 20, 517], the advisability of continuing the practice is convincingly demonstrated by the results of the tests herein reported.

Johnston (C. O.), Melchers (L. E.), & Miller (J. O.). **The Wheat stem rust epidemic of 1937 in Kansas.**—*Plant Dis. Reptr, Suppl.* 107, pp. 83–94, 2 graphs, 3 maps, 1938. [Mimeographed.]

In this account of the wheat stem [black] rust (*Puccinia graminis tritici*) epidemic in Kansas in 1937 [cf. *R.A.M.*, xvi, p. 25] the authors state that very heavy losses resulted in the eastern half of the State, and in some localities even greater damage was sustained than during the severe epidemic of 1935. Rainfall was below normal throughout May and June, except for a very slight excess in the central part of the State in May. In the development of wheat black rust epidemics minimum temperatures appear to be more important than mean and maximum temperatures, since heavy infections have not been noted locally until the minimum temperatures become high enough to favour abundant uredospore germination. The occurrence of some form of free moisture in the presence of relatively high minimum temperatures would be highly favourable to infection. In parts of Kansas, rank growth, due to light, frequent rains in May and June, conduced to heavy infection. There was no evidence that the rust overwintered in the uredo stage in any appreciable quantity. Preliminary data indicated that physiologic races 11 and 56 [ibid., xiv, p. 618; xvii, p. 381] were two of the most important present. The average loss caused by the disease throughout Kansas was 6·6 per cent., the total loss being estimated at 11,000,000 bush., rather more than $10,000,000 in value.

The soft red winter varieties, such as Fulcaster, Clarkan, Harvest Queen, and Michigan Wonder were heavily rusted in all sections of the State. In the north-east, Early Blackhull had the lowest percentage infection (though this variety appeared in only one test), and was followed, in order, by Kanred, Blackhull, Kawvale, and Iobred, the two last-named giving good yields.

PHIPPS (I. F.). **The effect of leaf-rust on yield and baking quality of Wheat.**—*J. Aust. Inst. agric. Sci.*, iv, 3, pp. 148–151, 1 fig., 1938.

In a study on leaf rust of wheat (*Puccinia triticina*), in which the disease was controlled by spraying with colloidal sulphur (1 in 500) plus agral spreader, applied at a rate of $\frac{1}{2}$ gal. per plot of 64 sq. links, sprayed and unsprayed plots of the susceptible variety Ranee showed 10 and 85 per cent. infection, respectively, and the yield of the unsprayed plots was lower by 14·5 per cent. Infection reduced the nitrogen content of the grain of Ranee wheat from an average of 2·869 to 2·673 per cent., and experimental loaves baked from samples of this wheat showed an average reduction in loaf volume from 578 to 510 c.c. for the standard bake, and from 708 to 640 c.c. when nymalt improver was added. Spraying with colloidal sulphur exerted no effect on the yield of a resistant hybrid (Gluyas×Hope). *P. graminis*, the other rust affecting wheat in Australia, was virtually absent from the experimental plots.

CASTELLANI (E.). **Osservazioni preliminari sulle ruggini del Grano nell' altopiano etiopico.** [Preliminary observations on Wheat rusts in the Ethiopian plateau.]—Reprinted from *Agricoltura colon.*, xxxii, 9, 10 pp., 2 graphs, 1 map, 1938.

Wheat is grown in Italian East Africa between latitudes 16° 30′ and 4° 30′ N. at altitudes from 1,700 to 3,200 m. above sea-level, and under widely different climatic and ecological conditions. Isolated heavy showers (separated by long intervals of drought) which may fall after the rainy season, together with high temperatures, very strongly favour the development and spread of rusts (*Puccinia graminis* [*R.A.M.*, xvii, p. 732], *P. glumarum*, and *P. triticina*). The first-named is the most serious disease of wheat in the colony, and causes enormous losses, while *P. triticina* does not appear to be responsible for much damage, though present in every wheat-growing area. *P. glumarum* occurs chiefly at very high altitudes. Drought subsequently aggravates the effects of rust infection.

Among the local wheats grown in Eritrea the most susceptible to the rusts is Amaharai, while Felasit shows slight resistance. In the vicinity of Lake Ascianghi some local black-eared wheats, apparently of good quality, were observed to show resistance. Among Italian wheats tested locally, Riale, Quaderna, and Edda were conspicuously resistant in two years' tests, and Mentana was most resistant of all, giving excellent yields even in a year when infection was exceptionally severe.

In the vicinity of Oletta (Central Abyssinia) a recently introduced wheat, Dicoftù, or European Sinde, referable to *Triticum polonicum*, showed much more resistance to *P. graminis* than the local wheat. In the experimental field at Olettà, among 15 Italian wheat varieties under test the most resistant to the three rusts were Messicano and families Nos. 20, 516, 517, and 43 of the same selection; Capinera and Azizia 302 were very resistant, and Rossia 33 and Duro Conti 45 somewhat less so.

The only species of barberry reported from Abyssinia are *Berberis petitiana* (= *B. aristata*) and *B. arguta*, the former being probably very

rare, as it was not found by the author, and the latter is known only from one locality; it is not known whether the aecidial stage of *P. graminis* occurs on these barberries.

Skvortzoff (S. S.). К физиологии гриба **Ustilago tritici (Pers.) Jens.** [On the physiology of the fungus *Ustilago tritici* (Pers.) Jens.]—*Pl. Prot., Leningr., 1938*, 16, pp. 65–78, 10 figs., 1938. [English summary.]

The author transferred monospore cultures of *Ustilago tritici* [*R.A.M.*, xvii, p. 434] on beer wort to various culture media and found that generally the fungus grew best on sterilized slices of potato or carrot, or on potato and carrot agar plus 3 per cent. glucose, the liquid media, with the exception of beer wort (7 per cent. sugar), and the synthetic being less favourable for its development. On solid media the mycelium grew in small, round lumps, which rose above the surface and eventually formed colonies with a granular wrinkled surface, while in liquid media the small lumps remained submerged. The rate of growth was slow, only 0·0049 gm. dry matter being formed after 60 days at 24° C. on Herzberg's liquid and 0·0060 gm. after 45 days on a solid medium. The minimum, optimum, and maximum temperatures for growth were found to be 7° to 9°, 22° to 24°, and 30° to 32°, respectively. The fungus withstood a temperature of 45° for 10 minutes, but was killed by exposure to the same temperature for 20 to 40 minutes, or to 55° for 1 to 5 minutes. It failed to grow on any medium under anaerobic conditions.

Vladimirskaya (Mme M. E.). Указания к расчету начальной температуры воды при термическом обеззараживании зерна против пыльной головни. [Calculation of the initial temperature of water for thermal disinfection of seed-grain against loose smut.] —*Pl. Prot., Leningr., 1938*, 16, pp. 118–122, 1938.

The author points out that in the usual wet treatment against loose smut of wheat [*Ustilago tritici*: see preceding abstract], in which the grain is pre-soaked in water at 28° to 32° C. for 4 hours and then immersed in water at 52° for 8 minutes, the temperature of the water is lowered when the grain, which is colder than the water, is added. The standard recommendation of making the initial temperature of the water 2° to 3° hotter is not considered satisfactory, as the final temperature of the water depends upon the following varying factors: amount of water, amount of grain, its temperature, its moisture content, and its specific heat. The correct initial temperature of the water (T_2°) can be calculated from two formulae, the first being $w = [(1-x_0)\ 0{\cdot}37 + x_0]\ (T_1^\circ - T_0^\circ)n$, and the second $T_2^\circ = \frac{w}{m} + T_1^\circ$, in which w is the number of calories needed to heat n kg. of grain from their original temperature T_0° to T_1°, the temperature required for the treatment, x_0 is the water content of the grain, 0·37 is the specific heat of starch (assuming that grain is entirely composed of starch), and m = litres of water used for treatment. A table of initial temperatures based on these equations is given for both the pre-soaking and steeping treatments for varying quantities of water and grain of different temperatures and water contents.

Pervukhina (Mme N. V.). К физиологии некоторых видов рода **Fusarium** на Пшенице. [Concerning the physiology of some species of *Fusarium* on Wheat.]—*Pl. Prot., Leningr., 1938*, 16, pp. 59–64, 1938. [English summary.]

In this study, conducted on similar lines to that of Mme Fedotova [*R.A.M.*, xv, p. 456] and using the same cultural medium, the pathogenicity of several species of *Fusarium* (of different geographical origin), as established by inoculation experiments by Tupenevitch, was found to be correlated with the amount of amine nitrogen accumulated by them per gm. of dry matter. The isolates 384 (actively parasitic), 885 and 93 (both parasitic) of *F. avenaceum* were found to accumulate 0·3556, 4·7413, and 4·9150 mg. of amine nitrogen, respectively; the isolates 1026 (parasitic) and 1020 (semi-parasitic) of *F. graminearum* [*Gibberella saubinetii*] accumulated 4·4487 and 8·4406 mg., respectively; and the isolates 821 of *F. sporotrichioides* and 316 of *F. scirpi* (both semi-parasitic) accumulated 7·0552 and 13·1647 mg., respectively. It appears from these results that the amounts of amine nitrogen formed by the various species do afford an indication of their pathogenicity. Data on three isolates of *F. avenaceum* and two of *G. saubinetii* showed, with one exception, that a direct correlation exists between the amount of amine nitrogen accumulated and the weight of mycelium produced.

Millikan (C. R.). **A preliminary note on the relation of zinc to disease in cereals.**—*J. Dep. Agric. Vict.*, xxxvi, 8, pp. 409–416, 7 figs., 1938.

The results of experiments, commenced in 1936 on several farms in the Wimmera district of Victoria, showed that Free Gallipoli wheat treated with zinc sulphate at rates of 15 and 30 lb. per acre, in conjunction with superphosphate, exhibited a superior growth, earlier maturity, and an increased yield as compared with plants receiving superphosphate only [cf. *R.A.M.*, xvi, p. 754]. Observations indicated that the plants treated with zinc produced a more vigorous root system and suffered less injury from eelworm (*Heterodera schachtii*) and the root-rot fungi (*Rhizoctonia* [*Corticium*] *solani*, *Helminthosporium sativum*, *H.* sp., *Fusarium* sp., *F. culmorum*, *Curvularia ramosa*, and *C.* sp.) than those treated only with superphosphate. A similar response in Mulga oats was observed in experiments made during 1937. In preliminary experiments with sand cultures, however, the addition of zinc to the nutrient solution did not produce an increased growth of the wheat plants comparable with that seen in the field. The addition of small quantities of zinc sulphate to the culture medium (glucose agar+ 0·1, 0·25, or 0·5 per cent. zinc sulphate) caused a marked retardation in growth and reduction of sporulation in *C. ramosa* and *H. sativum* as well as inducing variation in these species. Chemical analyses and extensive milling and baking tests showed that the zinc treatment had no significant influence on the milling and baking qualities of wheat.

Gaul (F.). **Beobachtungen über Getreide-Fusskrankheiten, insbesondere Halmbruchkrankheit.** [Observations on cereal foot rots, especially the straw-breaking disease.]—*Dtsch. landw. Pr.*, lxv, 36, pp. 461–462, 3 figs., 1938.

In the lime and red marl soils of the Hildburghausen (Franconia)

district of Germany, *Ophiobolus graminis* does not ordinarily cause appreciable damage except in wheat stands following barley, whereas for the last five years lodging of wheat due to *Cercosporella herpotrichoides* [*R.A.M.*, xviii, p. 15] has been prevalent. Observations in early July on the effects of a varying rotational sequence on the incidence of straw-breaking in a wheat crop revealed a complete absence of the disease in the plots following several years of sainfoin [*Onobrychis sativa*], black medick [*Medicago lupulina*] left standing for seed until the end of September, and late-harvested potatoes, while lodging occurred in the portion of the stand following potatoes lifted early. Besides a judicious scheme of crop rotation, other remedial measures include late sowing, methods of tillage calculated to bring the soil into the requisite state of tilth, and a well-balanced system of fertilizing.

IKATA (S.) & KAWAI (I.). **Some experiments concerning the development of yellow mosaic disease (white streak) of Wheat. Relation between the development of yellow mosaic disease of Wheat and soil temperature.**—*J. Pl. Prot.*, xxiv, pp. 491–501, 847–854, 1937. [Japanese. Abs. in *Jap. J. Bot.*, ix, 3, pp. (109)–(110), 1938.]

The virus of yellow mosaic (white streak) of wheat [*R.A.M.*, xvi, p. 665] was experimentally shown to enter its host exclusively through the roots and root-crowns, mostly at a soil-depth of about 3 cm. and never below 15 cm. The disease was not induced by a filtrate from infected soil. The optimum soil temperature for the development of yellow mosaic was found to be about 15° C., fairly severe effects being also observed at 10°, while at 20° the symptoms were inconspicuous, and at 25° imperceptible. The results of frame and field experiments confirmed the foregoing data.

WECK (R.). **Flugbrandbekämpfung bei Wintergerste in Eckendorf.** [Control of loose smut of Winter Barley at Eckendorf.]—*Nachr. SchädlBekämpf., Leverkusen*, xiii, 3, pp. 93–102, 1 fig., 1938.

This paper has already been noticed from another source [*R.A.M.*, xvii, p. 594].

STRAIB (W.). **Über eine nichtparasitäre Blattkrankheit an Keimpflanzen von Gerste.** [On a non-parasitic leaf disease of Barley seedlings.]—*Phytopath. Z.*, xi, 3, pp. 319–329, 4 figs., 1938.

Particulars are given of a disturbance, presumably metabolic in origin, occurring during the winter months on greenhouse barley seedlings at the Gliesmarode (Brunswick) branch of the Biological Institute, and characterized by the development on the leaf blades of greasy spots, rapidly giving place to a glassy necrotic condition of the tissues [cf. *R.A.M.*, xv, p. 352]. After the first leaf has reached maturity it seldom becomes affected, even under favourable environmental conditions (especially temperatures above 15° C. and abundance of light), though the new foliage may contract the typical grease-spot symptoms. In a test to determine the influence of different soil types on the incidence of the disease, Bavaria seedlings were most severely injured on heavy clay, grassland soil with a high proportion of humus, and light loam, whereas the trouble was practically absent on building and

quartz sands and completely so on compost, though in a further test the alkalization of the last-named with sodium carbonate (up to 32 c.c. per pot of 190 gm. soil) induced the glazed appearance. Soil reaction, therefore, plays an important part in the etiology of the barley spot under observation. Both ammonium sulphate and ammonium nitrate (5 c.c. of a 1·5 per cent. solution per pot) prevented the occurrence of necroses on Bavaria plants in clay, loam, loamy sand, sand, and grassland soils, but other nutrient salts exerted no conclusive action on the course of the disease, which is considered to be distinct from a somewhat similar condition described by Christensen from the United States [ibid., xiii, p. 761]. Over 500 barley varieties and a few of oats have been observed to suffer from the trouble in question, which may cause very considerable inconvenience in greenhouse inoculation experiments with parasitic fungi.

Coffman (F. A.), Murphy (H. C.), Stanton (T. R.), Burnett (L. C.), & Humphrey (H. B.). **New smut and rust resistant Oats from Markton crosses.**—*J. Amer. Soc. Agron.*, xxx, 10, pp. 797–815, 1938.

A definite programme was initiated in 1927 for the breeding of varieties of oats suitable for north-central United States conditions with combined resistance to stem [black] rust (*Puccinia graminis avenae*) and smuts (*Ustilago avenae* and *U. levis* [*U. kolleri*]) [*R.A.M.*, xvii, pp. 308, 451, 658, 738]. The smut-resistant variety Markton was crossed with the rust-resistant Richland, Iogold, Edkin, Iowa 444, and Rainbow. Some 5,000 selections and re-selections have been repeatedly subjected to inoculation with spores of the above-mentioned organisms and crown rust (*P. coronata avenae*) [*P. lolii*] in the greenhouse and field, and a number have been advanced to yield tests in plots.

Many of the selections have shown resistance to black rust and the two smuts through several seasons, while some Markton×Rainbow hybrids were also resistant to certain races of crown rust. The most promising selections were derived from crosses between Markton×Rainbow and Markton×Iogold, some of which offer exceptional agricultural possibilities in respect of bushel weight, stiffness of straw, and capacity to withstand drought.

Swanson (A. F.). **'Weak neck' in Sorghum.**—*J. Amer. Soc. Agron.*, xxx, 9, pp. 720–724, 1 fig., 1938.

Dwarf varieties of sorghum at Hays, Kansas, were extensively affected in 1937 by a disorder termed 'weak neck', which agrees in part with the description given by L. H. Pammel and collaborators of a *Fusarium* disease of the crop observed in Iowa (*Ia agric. Exp. Sta. Res. Bull.* 33, 1916). Symptoms of the trouble include disintegration of the peduncle tissues associated with a black or grey discoloration, extensive breaking-over of the heads at the juncture between the peduncle and upper node of the stalk, and poorly developed heads containing light-weight, lustreless seed. Aphids are commonly present on the diseased plants, but whether or not they act as vectors of bacterial or fungal infection remains to be determined.

All true sorgos appear to be highly resistant to 'weak neck', which

further causes little damage in strains of Blackhull Kafir and a new variety called Club. Milo and hybrids between it and Kafir are very susceptible. Observations on hundreds of hybrids of Club×Day and Wheatland Back-cross×Club, Day, and Colby milo, all originally derived from crosses with Dwarf yellow milo as one of the parents, showed that many were diseased. In the Club×Day progenies the yellow-seeded segregates generally showed a much higher degree of susceptibility than those with white seeds (resembling the Club parent). Semi-complete resistance to 'weak neck' was observed in the F_3 progenies of the cross Leoti Red sorgo×Club, while Wheatland was also fairly promising in this respect. No correlation was detected between *Pythium* root rot [*P. arrhenomanes*: *R.A.M.*, xvi, p. 741; xvii, p. 735] and 'weak neck' of sorghum.

FAWCETT (H. S.). **Transmission of psorosis of Citrus.**—Abs. in *Phytopathology*, xxviii, 9, p. 669, 1938.

Of the various methods of transmission tried in experiments on citrus psorosis [*R.A.M.*, xvii, pp. 313, 442, 595 and next abstract] in California, only the fusion of live cells of the diseased buds, bark, or root grafts with those of healthy plants yielded successful results. The recognition in 1933 of symptoms of the disease on the foliage provided a means of identifying certain species of citrus with apparently sound bark as carriers of the virus. Many such carriers are considerably more tolerant of the presence of the infective principle than those showing bark symptoms, such as sweet orange, grapefruit, and tangerine. The transmission of psorosis by budding to various species, varieties, and hybrids of citrus has been accomplished in numerous tests. The knowledge of foliar, as well as of bark, symptoms finds a useful practical application in the selection of virus-free sources for propagating bud wood in order to avoid the transmission of psorosis by this means.

FAWCETT (H. S.) & KLOTZ (L. J.). **Types and symptoms of psorosis and psorosis-like diseases of Citrus.**—Abs. in *Phytopathology*, xxviii, 9, p. 670, 1938.

Two types of citrus psorosis [see preceding abstract], A and B, induce similar bark symptoms in California, but the latter spreads more rapidly and results in gum formation, frequently well ahead of the cortical eruptions. Foliar symptoms consisting of small, pale areas, 1 to 3 mm. in diameter, on young, rapidly growing leaves are also similar in both types, but in older leaves the B form of the disease may cause the development of large, chlorotic ring spots resembling those of zonate chlorosis in Brazil [*R.A.M.*, xvii, p. 595], while A produces only occasional small, circular or semi-circular annular lesions. The fruit is seldom affected by A, whereas B gives rise to large, discoloured, circular to semicircular rings or grooves, the sunken tissue ranging from pale yellow to brown, with occasional necrotic breakdown; in the case of grapefruit, a bumpy, mis-shapen aspect may develop. In concave gum disease there are hollows in the bark, with gum-infiltrated layers in the wood and flecking of the young foliage similar to that typical of psorosis A and B. Possibly the latter are merely variants of a single virus closely related to concave gum disease. Leprosis [see

next abstract] in Florida is characterized by cortical symptoms on the older twigs somewhat resembling those of psorosis, but the rapidly growing foliage exhibits no particularly distinctive features and the circular lesions on mature leaves and on the fruit are entirely different. The leaf- and fruit-spotting associated with concentric ring spot in South Africa [ibid., xiv, p. 679] also has points in common with leprosis, and it is suspected that several disorders of the foregoing types are due to the same or nearly allied viruses.

BITANCOURT (A. A.). **Seira a Laranjeira Sabará resistente ou imune a leprose?** [Will the Sabará Orange be resistant to, or immune from, leprosis?]—*Biologico*, iv, 9, p. 300, 1938.

Attention is drawn to the high degree of resistance to leprosis [*R.A.M.*, xv, p. 291; xvii, p. 595], virtually amounting to immunity, shown in recent preliminary experiments in São Paulo, Brazil, by the Sabará sweet orange, a hybrid between the common sweet orange (*Citrus sinensis*) and the tangerine (*C. nobilis deliciosa*), the latter being as resistant as its offspring to the disorder under investigation. Local growers are urged to make further observations on the reaction of the Sabará variety to leprosis in proximity to infected trees.

MOREIRA (S.). **Xyloporosis.**—*Hadar*, xi, 8, pp. 234–237, 9 figs., 1938.

After briefly reviewing the work of Reichert and Perlberger and others on xyloporosis of citrus in Palestine [*R.A.M.*, xv, p. 647], the writer describes the occurrence of an apparently identical condition in Barão sweet oranges grafted on the Lima da Pérsia sour variety at the Limeira Citrus Station, São Paulo, Brazil, where his conclusions were verified by H. S. Fawcett and the cause of the disorder attributed to a specific disharmony between the stock and scion. Control may be effected by inarching with sour orange stock or top-working with Pêra orange or Persian lime. Several other instances of incompatible unions observed at the same Station are described, some of which, e.g., Gallego, Rio Claro, and Chrystal lemons grafted on sour orange, show typical symptoms of xyloporosis, while others are free from them. In Palestine the condition is probably attributable to a lack of harmony between the sweet lime stock and the Shamuti orange scion.

In a rejoinder I. Reichert and J. Perlberger state that xyloporosis cannot be explained solely on the basis of uncongeniality between graft partners, since a union between Shamuti orange and sweet lemon, for instance, has yielded copious crops for the last 50 years, though this is one of the factors under consideration with respect to the etiology of the disease.

[An expanded account of these studies in Portuguese, with an English summary, appears in *J. Agron., S. Paulo*, i, 3, pp. 217–226, 10 figs., 1938.]

FARKAS (A.). **The practical application of impregnated wrappers against fungal decay of Citrus fruit.**—*Hadar*, xi, 9, pp. 261–267, 1 graph, 1938.

A fully tabulated account is given of storage and shipping experiments carried out in 1937–8 to determine the value of diphenyl-impregnated wrappers in the control of fungal decay of oranges [chiefly

Penicillium digitatum, *P. italicum*, and *Diplodia natalensis*: *R.A.M.*, xiv, pp. 30, 506], the former at Rehoboth, Palestine, and the latter in collaboration with the Pardess Co-operative Society, which arranged for the transport of the fruit to England and its inspection on arrival.

With regard to the storage tests, the use of impregnated wrappers enabled the duration of the keeping period to be safely extended to one month under adverse conditions (ripe fruit, summer months) without recourse either to refrigeration or special ventilation; the amount of wastage did not exceed 2 per cent. in such consignments. In more favourable circumstances the treated fruit can be stored for two months, or early pickings even longer. When decay ultimately sets in, the fruit remains dry and does not contaminate the adjacent sound oranges. In shipped fruit the wastage in diphenyl-treated fruit was well below 5 per cent. under normal conditions and did not reach 7 even under the most unfavourable.

In the course of a discussion on the commercial applicability of the treatment, which incidentally controlled 'nooksan' [ibid., xvii, p. 595], it is mentioned that the slight but characteristic odour of diphenyl could no longer be detected on the fruit after two to three weeks' storage, and further that recent chemical analyses by a London official revealed absolutely no trace of the substance in the wrapped orange itself and only 0·1 mg. in the peel. It is calculated, on a conservative basis, that an annual saving of £100,000 on the Jewish crop of 7,000,000 boxes could be effected by the systematic use of diphenyl-treated wrappers, a considerably more economic method of treatment than the provision of refrigerated vessels.

Trout (S. A.), Tindale (G. B.), & Huelin (F. E.). **The storage of Oranges with special reference to locality, maturity, respiration, and chemical composition.**—*Pamphl. Coun. sci. industr. Res. Aust.* 80, 59 pp., 14 graphs, 1938.

In experiments with Washington Navel oranges exposed in a sweating chamber to temperatures of 78° to 90° F. and a humidity of either 50 or 85 per cent. saturation for three to five days prior to storage (at 40°), none of these treatments was effective in combating mould (*Penicillium digitatum*) [*R.A.M.*, xvii, pp. 26, 741] when the fruits were wounded and inoculated before sweating, whereas when the fruits were sweated first the mould was largely controlled, 70 per cent. wastage developing after four weeks under the former conditions and only 2 per cent. under the latter.

Fruit with shallow wounds and unwounded fruit, picked on 8th July, developed 25 and 10 per cent. mould, respectively, after ten weeks in storage at 40°, whereas fruit picked on later dates developed mould more rapidly, wounded and unwounded fruit picked on 2nd September showing 25 and 10 per cent. mould, respectively, after only five weeks. In another experiment fruit picked on 8th July became unpalatable after ten weeks and developed 10 per cent. mould after twelve, while the fruit picked on 2nd September became unpalatable after three weeks and developed 10 per cent. mould after five. In further experiments with fruit picked at different dates and stored at 40° it was found that the period between the time of picking and the loss of

palatability and subsequent development of mould, in short, the storage life of the fruit, is longer at an early date of picking than at any later one, by approximately the same period as that between the two picking dates. In fruit from Merbein settlement 10 per cent. mould wastage developed about six weeks after the loss of palatability, while in fruit from Lockington moulding occurred at the same time as the loss of palatability. In experiments with fruit from five separate districts picked at different dates it was found that the storage life of the fruit was terminated by loss of palatability in all cases except two, when it was ended by the occurrence of storage spot, the mould development occurring either simultaneously or two to three weeks later.

STREETS (R. B.). **A nursery blight of Citrus caused by Phytophthora citrophthora.**—Abs. in *Phytopathology*, xxviii, 9, p. 673, 1938.

An unusual disease of nursery citrus trees involving sudden wilting and death of the leaves and stem-blackening within a zone 6 to 12 in. long, just above the bud union, is reported [? from Arizona]. The wood of the sweet seedling orange scion was definitely discoloured, and a white, cottony fungal growth developed on agar cultures of the wood and inner bark. The sour orange rootstock was unaffected. The fungus proved to be indistinguishable in cultural characters and pathogenicity from *Phytophthora citrophthora,* so that the trouble under observation is evidently a hitherto undescribed form of brown rot gummosis [*R.A.M.*, xvii, p. 313]. Favourable conditions for infection were induced by the heavy, wet soil and close covering of the 'lath house' in which the trees were growing. Several hundred trees were rendered worthless by the disease, but the uninfected ones were saved by the prompt application of Bordeaux mixture.

DOIDGE (E[THEL] M.). **The successful eradication of Citrus canker in South Africa.**—*Fmg S. Afr.*, xiii, 151, p. 400, 1938.

The history of the eradication of citrus canker (*Bacterium* [*Pseudomonas*] *citri*) from South Africa [*R.A.M.*, xv, p. 425] is briefly outlined. The campaign strenuously waged against the disease since its detection in 1917 culminated in 1938 in the abolition of all planting restrictions.

LEACH (R.). **Report of the Plant Pathologist, Mlanje Experiment Station.** —*Rep. Dep. Agric. Nyasald, 1937*, pp. 27–30, 1938.

During the period under review, citrus trees in Nyasaland badly affected with mottle leaf [*R.A.M.*, xvii, pp. 16, 743] regained a healthy colour after spraying with zinc sulphate-lime (10–5–100). No sticker or spreader was used. Other mycological work was much restricted.

TAYLOR (G. G.) & BURNS (M. M.). **'Mottle-leaf' of Citrus in New Zealand.**—*N.Z. J. Sci. Tech.*, A, xx, 2, pp. 115–119, 4 figs., 1938.

Mottle leaf of citrus, which is stated to be assuming increasing importance in the Auckland, Bay of Plenty, and Hawke's Bay districts of New Zealand, affecting Eureka and Lisbon lemons, Poorman orange (or New Zealand grapefruit), and all sweet orange varieties, has so far (fifteen months after treatment) failed to respond by any improvement to zinc sulphate sprays [see preceding abstract], but very promising

results have been given in preliminary tests in the Auckland area by applications of manganese sulphate plus hydrated lime at a strength of 5–2½–100.

Duthie (D. W.). **Coconut wilt in Essequibo and Pomeroon districts.**—*Agric. J. Brit. Guiana*, ix, 3, pp. 147–152, 1938.

Field observations on the Essequibo coast showed that coco-nut trees 15 to 25 years old, growing both on clay and sand, were affected by wilt, the symptoms of which were almost identical with those observed in Trinidad [*R.A.M.*, xvii, p. 390]. The disease is believed to be caused by planting coco-nuts after sugar-cane, a shallow-rooted crop, in abandoned sugar-cane estates, where the subsoil is too compact and saline to allow easy root penetration. The well-drained, highly organic top soil favours the rapid growth of young coco-nuts and the development of roots near the surface, with the result that the trees live on the verge of drought. The safest method of preventing the occurrence of the disease would be to leave the land in bush for a few years before replanting.

Coco-nuts growing on the banks of the Pomeroon River on soils varying from deep pegasse to pegasse clay, were found to grow particularly well at first but to wilt after about 10 years, whereas trees growing on the dams may live for 20 to 30 years. The disease under these conditions is attributed, in agreement with Bain's explanation [loc. cit.], to the high water-table (in wet seasons 18 to 24 inches below the surface at high tide), which limits the root growth and thus makes the trees unable to withstand dry seasons and the strain of bearing. Coco-nuts should, therefore, be planted only on land which is at least 6 ft. above the water-level of the river at high tide.

Bliss (D. E.). **Spoilage of Dates as related to management of the fruit bunch.**—*Rep. Date Grs' Inst., 1938*, pp. 7–12, 6 figs., 1938.

In field experiments carried out in California from 1935 to 1937, inclusive, to ascertain the effect on spoilage of Deglet Noor date fruits (including disease and injuries) of aeration and thinning of the fruit bunch, aeration was effected by (1) separation of the fruit strands by the insertion of wire rings, (2) protecting the bunches with an aerated type of paper bag allowing increased ventilation, and (3) removal of the fruit strands from the centre of the bunch. The results obtained [which are tabulated] showed that in 1935 checking (development of small, transverse ruptures in the epidermis) was considerably reduced by aeration, and fungal rots [unspecified] even further diminished. In 1936 checking and black nose [*R.A.M.*, x, p. 657] were severe on all the experimental lots, while rotting was about twice as great in the lightly thinned as in the heavily thinned bunches. In 1937, when no rain fell during ripening, losses were very small, and the different treatments did not have marked effects.

It is concluded that the removal of 50 to 60 per cent. of the fruits per bunch is desirable. The use of wire rings is advised during the critical time of ripening, but if no rain falls and the aeration is excessive, the rings should be removed. Bags permitting free circulation of the air are recommended.

Venkatarayan (S. V.). **Coffee black bean.**—*Curr. Sci.*, vii, 3, pp. 113–114, 1 fig., 1938.

Observations in Mysore showed that coffee black bean [*R.A.M.*, xvii, p. 813] is associated with absence of the embryo. Black bean fruits develop on the plant just as the others do, and may sometimes be detected by the sense of touch, as owing to reduced turgidity they feel wilted to the fingers. The affected fruits remain attached to the plant until the other fruits mature. It is suggested that the condition may possibly result from a failure of pollination or fertilization. Sterility has been known in coffee, and the fruit may develop parthenogenetically, if there is absence or incompatibility of pollen. It is possible that many coffee plants which are natural hybrids develop some of their fruits parthenogenetically. Feng found that the seeds of Asiatic-American cotton hybrids contained either a very small embryo or none at all, even though possessing well-developed seed coats, and stated (*Bot. Gaz.*, xcvi, pp. 485–504, 1935) that 'the ovules of the sterile F_1 hybrids were shrunken, dry, and black; no fibres developed on the seed coats. The ovules apparently do not develop at all'. This is somewhat similar to what happens in the case of coffee black bean.

Chester (K. S.). **Gravity grading, a method for reducing seed-borne disease in Cotton.**—*Phytopathology*, xxviii, 10, pp. 745–749, 1938.

Laboratory, greenhouse, and field experiments on cotton seed germination and emergence indicate that nearly all weak and diseased material (internally infected, e.g., by *Glomerella gossypii*, *Bacterium malvacearum*, and *Fusarium moniliforme* [*Gibberella fujikuroi*]) may be eliminated by delinting the seed with concentrated sulphuric acid, followed by suspension in water and separation of the sinking from the floating fractions, the former being used for planting and the latter (ordinarily constituting about 40 per cent. of the whole by weight) sold for processing. Healthy germination and emergence of the heavy seed were over twice and $1\frac{1}{2}$ times as great, respectively, as in the light and ungraded delinted seed batches.

Nettles (W. C.). **Cottonseed treatment gives larger yield.**—Abs. in *Phytopathology*, xxviii, 9, p. 665, 1938.

A substantial reduction in the incidence of sore shin of cotton [*Corticium solani*] is stated to have been effected in South Carolina in 1937 by seed treatment with ceresan [*R.A.M.*, xvi, p. 315], which reduced the incidence of infection over an area of 250,000 acres from 60 to 16 per cent. On 115 farms situated in various parts of the State, the treated seed yielded 16·7 per cent. more bolls than the untreated, equivalent to an extra 205 lb. seed cotton per acre. These figures are based on partial returns only, and it is estimated that the total value of the increase over the area under observation for 1937 will amount to $1,537,500.

Dick (J. B.) & Tisdale (H. B.). **Fertilizers in relation to incidence of wilt as affecting a resistant and a susceptible variety.**—Abs. in *Phytopathology*, xxviii, 9, pp. 666–667, 1938.

Experiments at the Alabama Experiment Station in 1937 to

determine the effect of 27 different combinations of nitrogen, phosphate, and potash on the incidence of cotton wilt [*Fusarium vasinfectum*: *R.A.M.*, xviii, p. 24 and next abstracts], in a resistant (Cook 307) and susceptible (Half and Half) variety, showed that joint applications of nitrogen and potash effectively reduce wilt and increase yields, whereas the inclusion of phosphate in the treatment materially increases the amount of infection, the normally beneficial action of the last-named element on productivity being thus largely counteracted.

TISDALE (H. B.) & DICK (J. B.). **Cotton varieties in relation to Cotton wilt.**—Abs. in *Phytopathology*, xxviii, 9, p. 667, 1938.

No evidence was obtained in the course of studies in Alabama during 1936–7 for the existence of physiologic races of the cotton wilt organism [*Fusarium vasinfectum*: see preceding and next abstracts], notwithstanding marked differences in virulence according to situation and local environmental conditions. Resistant varieties benefit more than susceptible ones from moderate applications of potash, an excess of which, in fact, is liable to damage the former while not adversely affecting the latter. These observations are considered to point to a relationship between wilt resistance and capacity for potash utilization.

CRALLEY (E. M.) & THARP (W. H.). **Field studies on Fusarium wilt of Cotton in Arkansas. The relation of 'wilt' and 'total infection' as influenced by potash fertilization.**—Abs. in *Phytopathology*, xxviii, 9, p. 667, 1938.

In potash fertilization experiments on three cotton varieties—resistant, tolerant, and susceptible—in two localities of Arkansas in 1936 and 1937, infection by the wilt fungus [*Fusarium vasinfectum*: see preceding abstracts] was found to develop progressively with advance in season in the three types in the order named. Significant differences in relative disease severity between potash-fertilized and untreated plants did not become conspicuously apparent until late in the growing season. Applications of potash after planting decreased in efficacy concurrently with the lapse of time between planting and treatment.

EZEKIEL (W. N.). **Cotton root rot in Texas in 1937, and conditions affecting its local prevalence.**—*Plant Dis. Reptr*, xxii, 15, pp. 315–324, 6 graphs, 1 map, 1938. [Mimeographed.]

A survey of 770 cotton fields in 22 counties of Texas, made in 1937, showed that root rot (*Phymatotrichum omnivorum*) [*R.A.M.*, xvii, p. 590] was less abundant than usual, presumably on account of general low precipitation during the growing season. The losses for the whole State for 1937 are estimated to amount to about 300,000 bales of cotton, or 5·9 per cent. of a normal yield. Multiple correlation analysis of losses in ten selected counties showed that under equally favourable soil conditions an increase of 4 in. of rainfall in April, May, June, and July could be correlated with about 15, 15, 20, and 30 per cent. increases in root rot, respectively, while additional rainfall in August had no effect on the percentage of infection. The disease was not prevalent in areas with a mean annual air temperature of 60° F. or below, being more abundant at higher temperatures. The presence or absence of

root rot in the different sections of Texas appears to be determined largely by the relative prevalence of the favourable neutral to slightly alkaline soils and high mean temperatures, its destructiveness in any year being dependent chiefly on rainfall.

BOCZKOWSKA (Mme M.). **Próby zwalczania płaszczyńca Burakowego Piesma quadrata Fieb. grzybem owadożernym.** [Attempts to control the Beet leaf bug *Piesma quadrata* Fieb. by means of an entomogenous fungus.]—Reprinted from *Roczn. Ochr. Rośl.*, v, 5, 23 pp., 5 figs., 1938. [French summary.]

In laboratory experiments on the biological control of the beet leaf bug *Piesma quadratum*, the vector of beet crinkle [*R.A.M.*, xvii, p. 642], conducted during the years 1935 to 1937 in Poland, the larvae and imagines of this insect were artificially inoculated with an unspecified species of *Beauveria* either by means of pure cultures or of direct transfers from dead insects, and placed on leaves of living plants, which were then enclosed in bags. Signs of disease appeared three days after inoculation, dead insects were found two days later, and most were killed within a week, larvae and imagines being equally susceptible. The fungus was able to infect the insects at an air humidity varying from 56 to 100 per cent. saturation (the temperature being about 18° C.), but to fructify only at 100 per cent.

The results obtained in the laboratory were confirmed by field trials, in which from 55 to 86 per cent. of the inoculated insects enclosed in bags or flasks were killed in 13 days. The fungus suffers, however, from the disadvantage of needing a long incubation period, thus allowing the appearance of a second generation of the insect, and of failing to fructify in case of drought. Attempts to infect the beet bug in the field without using any kind of enclosure reduced the number of imagines in the spring but was without effect on the second generation.

BLUNCK (H.). **Feinde und Krankheiten der Maikäfer.** [Enemies and diseases of the Cockchafer.]—*Z. PflKrankh.*, xlviii, 9–11, pp. 488–507, 9 figs., 1938.

Among the natural enemies of the cockchafer (*Melolontha melolontha*) discussed in this survey of the subject are *Beauveria densa* [*R.A.M.*, xvii, p. 816] and *Cordyceps militaris* [ibid., xvi, p. 532], as well as bacteria (*Bacillus melolonthae* and a *Coccobacillus*).

KARLING (J. S.). **Harposporium anguillulae.**—*Mycologia*, xxx, 5, pp. 512–519, 18 figs., 1938.

As a result of an intensive study of the Hyphomycete *Harposporium anguillulae*, found on nematodes, the author concludes that *Polyrhina multiformis* is a synonym of this species. The conidiophore arises as a papillate bud from a branch of the internal mycelium, which may be enlarged to a bulbous structure. The bud pierces the host wall, elongates, and becomes delimited by a basal wall. Further growth takes place and transverse walls are usually formed dividing the conidiophore into four linear segments. Globular cells are produced on these segments and develop elongated, curved, cylindrical apical beaks, which are abstricted as conidia, only one conidium being formed from a globular

cell. The conidiophores vary considerably in structure and range from 6 to 60 μ in length and 2·5 to 4 μ in breadth, and the number of linear segments varies from 0 to 5. They may bear secondary, tertiary, or even quaternary globular cells. The conidia measure 5 to 14 by 1·5 to 2·5 μ. Thick-walled, intramatrical, hyaline resting cells, which the author regards as chlamydospores, occurred singly or in chain-like groups, were usually rectangular, slightly swollen, somewhat oval and barrel-shaped, measured from 3·5 to 7 μ in length by 4 to 6·6 μ in diameter, and were sometimes almost isodiametric. Numerous germinating chlamydospores were observed.

Castellani (A.). **Smooth and rough forms of Monilia tropicalis Cast. in the sputum of the same patient.**—*J. trop. Med.* (*Hyg.*), xli, 17, pp. 277–279, 6 figs., 1938.

Particulars are given of two cases of bronchomoniliasis caused by *Monilia* [*Candida*] *tropicalis* [*R.A.M.*, xvi, p. 484] in which the patients' sputum contained both smooth and rough forms of the fungus [cf. ibid., xvii, p. 677]. In one case (a 60-year-old woman, details of whose condition were presented in *J. trop. Med.* (*Hyg.*), 1st October, 1935, by the author and T. Standring) the smooth and rough strains remained true in subcultures for a period of about eight months, at the end of which the rough one gradually reverted to the smooth state and has since remained smooth. In the case at present under observation (a 41-year-old man) the smooth and rough strains had maintained their individual characters for two months at the time of writing.

Ambrosioni (P.). **Contributo allo studio delle onicomicosi da blastosporee.** [A contribution to the study of onychomycoses due to Blastosporeae]—*G. ital. Derm. Sif.*, lxxix, 3, pp. 671–676, 1 pl., 1938.

From the middle digit of the left hand of a 60-year-old woman suffering from an intractable onychomycosis the writer isolated in pure culture on Sabouraud's and other standard media at the Microbiological Institute, Rome, a fungus corresponding in morphological, cultural, biochemical, and biological characters with Castellani's *Monilia krusoides* (*J. trop. Med.* (*Hyg.*), xl, p. 304, 1937), which the writer, however, prefers to designate *Mycotorula krusoides* (Cast.). Positive results were obtained in intravenal inoculation experiments on rabbits.

Durham (O. C.). **An unusual shower of fungus spores.**—*J. Amer. med. Ass.*, cxi, 1, pp. 24–25, 1 map, 1938.

Attention is drawn to a remarkable instance of the atmospheric transport of mould allergens in the form of *Alternaria* and *Hormodendrum* spores on 6th and 7th October, [1937], throughout the eastern part of the United States [*R.A.M.*, xvii, p. 599]. During this period thousands of tons of mould spores were transported for an average distance of several hundred miles. At 17 stations on and east of the Mississippi, where records were taken, the average increase in the *Alternaria* spores during the storm was 100 times that of the mean daily count for the month. At no time in the course of the writer's ten-year study on atmospheric pollen in relation to hay-fever has the

transfer of allergenic particles been observed in such large amounts or over so widespread an area.

FRAENKEL (E. M.). **Moulds and asthma.**—*Brit. med. J.*, *1938*, 4044, pp. 68–69, 1938.

After briefly reviewing previous work on the relationship between moulds and certain respiratory diseases [*R.A.M.*, xvii, p. 821, and preceding abstract], the writer reports the results of the examination of 185 allergic patients in England, of whom 148 (92 males and 56 females) suffered from asthma and 21 from hay-fever and rhinitis. Of the 80 males tested for skin reactions with moulds, 41 (51 per cent.) gave positive results, the corresponding figure for the 51 females being 28 (55 per cent.). Of 290 male patients similarly tested by the writer in Germany only 43 (15 per cent.) reacted positively to moulds, the comparable figures for 232 females being 41 (18 per cent.). Roughly speaking, the English figures agree with those reported by Schonwald from Seattle [Washington: ibid., xvii, p. 395], the prevalence in both cases being probably associated with the damp climate, while those from Germany approximate more closely to records from the interior of the United States.

HENRICI (A. T.). **An endotoxin from Aspergillus fumigatus.**—Abs. in *J. Bact.*, xxxvi, 3, p. 278, 1938.

Cell sap from a pathogenic strain of *Aspergillus fumigatus* was found to be toxic to rabbits, guinea-pigs, mice, and chickens [*R.A.M.*, xiii, p. 510; xv, p. 804], while the broth filtrate is innocuous. A less degree of toxicity is shown by the cell sap of pathogenic strains of *A. flavus* and *A. oryzae*. The cell sap is haemolytic *in vitro*. In the symptoms induced in experimental animals by injections the toxin closely resembles that of *Amanita phalloides*, from which it differs, however, in being thermolabile and non-toxic by oral administration. The *Aspergillus* toxin withstands 45 minutes' exposure to a temperature of 55° C., but it is inactivated by 15 minutes at 62°. Rabbits and guinea-pigs may be gradually immunized to tolerate ten or more lethal doses; the serum of actively immunized rabbits affords protection to guinea-pigs, and neutralizes the haemolytic action of the toxin *in vitro*.

PROKOPTCHOUK (A.). **Klinische und experimentelle Angaben über Chromomycosis.** [Clinical and experimental data on chromomycosis.]—*Vyestn. Venerol. Derm.*, *1938*, 3, pp. 21–27, 1938. [Russian. Abs. in *Zbl. Haut- u. GeschlKr.*, lx, 12–13, p. 628, 1938.]

Fourteen cases of verrucose, tuberous, nodular, and overlapping types of chromoblastomycosis, the first-named attributed by Jaczewski to *Hormodendrum rossicum* [*R.A.M.*, xvii, p. 529], are stated to have been observed in the U.S.S.R. Inoculations with fungal material from diseased tissues on rabbits, guinea-pigs, and rats, resulted in pustules, which gave rise in pure culture to the typical dark green, velvety colonies of *Hormodendrum*.

MABALAY (E. B.). **Studies on the cultivation of Pityrosporon of Malassez.**—*Mon. Bull. Philipp. Hlth Serv.*, xviii, pp. 15–19, 1938. [Abs. in *Zbl. ges. Hyg.*, xliii, 1, pp. 72–73, 1938.]

From skin scrapings in a case of achromia symmetrica (plantilla)

treated at the Cebu (Philippines) Skin Dispensary the writer isolated on Sabouraud's dextrose agar, with the addition of 3 to 5 drops of sterile coco-nut oil per 100 c.c., ampulliform structures of the *Pityrosporum* of Malassez [*P. malassezi*: *R.A.M.*, xvi, p. 609], which formed moist, white, later darkening colonies. Gelatine was not liquefied, and neither acid nor gas was produced from dextrose, lactose, or other sugars. Hyphae were not formed. Olive, cottonseed, and castor oils and lard also stimulated the development of the fungus, which responded less favourably to beeswax or vaseline and failed to grow in the presence of paraffin, cedar, or *Wightia* oil. Mild inflammatory disturbances were induced in guinea-pigs by inoculation on shaved areas of the skin.

Zenin (A. S.). **Zur Ätiologie und Epidemiologie der Dermatomykosen im Kuibyschewgebiet.** [On the etiology and epidermiology of the dermatomycoses in the Kuibyscheff district.]—*Vyestn. Venerol. Derm.*, *1938*, 2, pp. 5–9, 1938. [Russian. Abs. in *Zbl. Haut- u. GeschlKr.*, lx, 10–11, p. 513, 1938.]

Trichophyton violaceum [*R.A.M.*, xviii, p. 27] was found to be responsible for a very high proportion (93·8 per cent.) of the 1,666 cases of dermatomycosis handled during a period of four years in the Kuibyscheff district of the U.S.S.R. [ibid., xvii, p. 245]. By means of intensive propaganda a substantial reduction in the incidence of infection was achieved (from 1,266 cases of trichophytosis in 1933 to 451 in 1936). Favus was diagnosed in 3·75 and 12·2 per cent. of the urban and rural cases, respectively, while microsporosis occurred only four times.

Ch'in (T. L.). **Potassium tellurite and copper sulphate in Sabouraud's medium for isolation of pathogenic fungi.**—*Proc. Soc. exp. Biol., N.Y.*, xxxviii, 5, pp. 700–702, 1938.

In isolating on Sabouraud's glucose agar *Trichophyton violaceum*, *Microsporon ferrugineum* [*R.A.M.*, xv, p. 580], *Achorion schoenleini*, *Epidermophyton* [*Trichophyton*] *rubrum*, and *E. inguinale* [*E. floccosum*] from infected human hair and skin at the Peiping [Peking] Union Medical College, bacterial contamination was effectively prevented by the addition to the medium of 0·015 per cent. potassium tellurite or 0·05 per cent. copper sulphate. *A. schoenleini* was more resistant to these chemicals than the other fungi tested, growing well at a concentration of 0·02 per cent. potassium tellurite or 0·06 per cent. copper sulphate.

De Verebélÿ (T.). **Morphologie de l'hyphomycosis pedis.** [The morphology of 'hyphomycosis pedis'.]—*Pr. méd.*, *1938* (I), 51, pp. 989–992, 7 figs., 1938.

The writer fully describes and discusses two cases of the so-called 'Madura foot' [*R.A.M.*, xvii, p. 747] (for which the designation 'hyphomycosis pedis' is preferred as more explanatory and correct) studied in Hungary 30 years ago, but previously reported in Hungarian only and therefore omitted from current bibliographical surveys of the relevant literature. Both patients were young men, one a weaver and the other a farmer, who contracted the disease as a sequel to injuries

to the foot. Material from the infected tissues gave rise in pure culture to white granules in one instance and to black ones in the other; the morphological characters of the fungus in both cases agreed with those of *Indiella mansoni* [cf. ibid., vi, p. 612 *et passim*].

Mayerhofer (E.) & Dragišić (B.). **Weiterer Bericht über kindliche Maisbrandvergiftungen (Ustilaginismus).** [A further report on juvenile cases of Maize smut poisoning (ustilaginism).]—*Z. Kinderheilk.*, lix, 5, pp. 543–552, 4 figs., 1938.

Further investigations at the Zagreb (Yugoslavia) University Children's Hospital on maize smut poisoning (ustilaginism) are described in connexion with 15 fresh cases, and comparative details given of the spontaneous symptoms of the disease in a child and those artificially induced in mice by inoculation with the principal agent, *Ustilago maidis* [*U. zeae*: *R.A.M.*, xvii, p. 526; xviii, p. 18], agreement being observed in eight symptom groups. Ustilaginism is stated to be closely allied to true infantile acrodynia, from which it differs mainly in its etiology. In addition to *U. zeae*, *U. reiliana* [*Sorosporium reilianum*] may be implicated to some extent in the causation of ustilaginism, whereas *U. fischeri* is of negligible importance in this respect.

Henry (A. W.) & Campbell (J. A.). **Inactivation of seed-borne plant pathogens in the soil.**—*Canad. J. Res.*, Sect. C., xvi, 9, pp. 331–338, 1938.

In a study on the antibiotic action of soil micro-organisms, flax seeds naturally and artificially infected with *Polyspora lini* [see above, p. 88] and artificially inoculated with *Colletotrichum lini* [*R.A.M.*, xvi, p. 676] was used in several series of pot experiments. In five experiments with *P. lini* and the susceptible Bison flax the percentages of diseased seedlings in sterilized and unsterilized soil were 12 and 2·1, 17·9 and 5·4, 29·1 and 4·2, 18·8 and 1·9, and 14·3 and 1, respectively, showing in each case a reduction of infection in natural soil, ascribed to the activity of soil micro-organisms. When flax seed naturally infected with *P. lini* was treated with 95 per cent. alcohol (by dipping and flaming), leytosan P (methyl mercury phosphate) [ibid., xvii, p. 605], or formalin (1 in 320) prior to sowing, the same reduction in infection was observed on natural soil, indicating that the micro-organisms were capable of inactivating the internally borne inoculum, which was not affected by the fungicides. In three experiments with *C. lini* the percentage of diseased seedlings on sterilized and unsterilized soil at soil temperatures of 12°, 17°, and 24° C. was 53 and 14, 71 and 18, and 75 and 19, respectively. A bacterium [unspecified] was found causing rapid disintegration of the conidia of *C. lini* in the soil. Analogous experiments with the wheat bunt fungi [*Tilletia caries* and *T. foetens*] did not yield consistent results and are being continued.

Wollenweber (H. W.). **'Sphaerella linicola' n. sp. die Ursache der Amerikanischen Leinpest (Pasmo- oder 'Septoria'-Krankheit).** [*Sphaerella linicola* n. sp., the agent of the American Flax epidemic ('spasm' or *Septoria* disease).]—*Rev. Bot. Inst. 'Miguel Lillo'*, ii, 2a, pp. 483–494, 1 pl., 1938. [Spanish summary.]

One of a number of specimens of flax straw from the Argentine

procured for purposes of comparison with American and European material, all affected by the 'spasm' disease hitherto attributed to *Septoria linicola* (syn. *Phlyctaena* (?) *linicola*, *Septogloeum linicola* [*R.A.M.*, xvii, p. 458]), bore black perithecia on the stunted, dark brown, necrotic main axis. Ascospores from these organs gave rise to the typical pycnidia of *Septoria linicola* in culture, preceded by the formation of free conidia of the *Septogloeum* stage. These are cylindrical and similar to the pycnospores but are often somewhat larger. In the body of the paper the perfect stage of the flax pathogen is named *Sphaerella linicola* n. sp. [with diagnoses (also of the pycnidial and conidial phases) in Latin and German], but an introductory note explains that, when the article was already in print, it was discovered that the name *Mycosphaerella linicola* had previously been applied to a different fungus with larger perithecia attacking the same host in the U.S.S.R. [ibid., v, p. 611]. In conformity with the recent acceptance of the generic name *Sphaerella* in place of *Mycosphaerella* [ibid., xvii, p. 841], the latter organism is renamed *S. linicola* (Naoum.) Wr. n. comb.; in order to avoid confusion, therefore, the author changes the name of his fungus to *S. linorum* n. sp.

The caulicolous, scattered, rarely aggregated, almost black, erumpent perithecia are approximately spherical to oval, rarely bulb-shaped, mostly 70 to 100 by 60 to 90 (extreme limits 40 to 130) μ (mean 90 by 74 μ), occupied by numerous fasciculate, oblong to clavate or subcylindrical, sessile, straight, curved, or tortuous, hyaline asci, 36 to 55 by 7 to 10 (43 by 8·5) μ, containing eight irregularly biseriate, obliquely uniseriate, or asymmetrically distributed, hyaline, fusiform, mostly curved, septate ascospores, 11 to 17 by 2·5 to 4 (13·4 by 3·3) μ.

DEARNESS (J.). **Sphaceloma rosarum as Gloeosporium rosaecola.**—*Mycologia*, xxx, 5, pp. 561–562, 1938.

The name *Gloeosporium rosaecola* Dearn. & Barth., for a fungus on roses collected in August, 1928, at Stockton, Kansas, was included without description in the list of Kansas fungi published in *Trans. Kans. Acad. Sci.*, xxxiii, pp. 82–83, 1930. Later the fungus was thought to be identical with *Sphaceloma rosarum* [*R.A.M.*, xvii, p. 683] and this has been confirmed by Dr. Anna E. Jenkins to whom specimens were sent.

VAN EEK (T.). **Root-rot of Viola tricolor maxima Hort.**—*Phytopath. Z.*, xi, 3, pp. 217–281, 3 pl., 11 figs., 7 graphs, 1938.

This is an English translation of the author's Dutch thesis on the root rot of cultivated pansies (*Viola tricolor*) in Holland, associated with numerous fungi, including *Pythium de Baryanum*, *P. aphanidermatum*, *P. perniciosum*, *Brevilegnia gracilis*, *Fusarium culmorum*, and *Rhizoctonia* [*Corticium*] *solani*, a notice of which has already appeared [*R.A.M.*, xvi, p. 813].

DOIDGE (E[THEL] M.). **A common disease of Dahlias.**—*S. Afr. hort. J.*, i, 1, p. 12, 1938.

Attention is drawn in a brief, popular note to the increasing prevalence in South African gardens of tomato spotted wilt on dahlias

[*R.A.M.*, xvii, p. 443], and directions given for its control by simple cultural precautions.

MIDDLETON (J. T.), TUCKER (C. M.), & TOMPKINS (C. M.). **Pythium disease of fibrous-rooted Begonia.**—Abs. in *Phytopathology*, xxviii, 9, p. 672, 1938.

Bedding plants of the Fire Sea variety of fibrous-rooted begonia at Berkeley, California, and greenhouse plants of Carmine, Christmas Cheer, and Primadonna at Columbia, Missouri, were affected by a disease causing discoloration, water-soaking, and flaccidity of the crowns, stem bases, and leaves, sometimes followed by collapse of the stem and abscission of the infected foliage. When potted plants were grown close together the disease spread by means of the leaves to a serious extent. Isolations from the Californian material yielded *Pythium ultimum*, while *P. de Baryanum* [*R.A.M.*, xii, p. 448], *P. splendens*, and *P. ultimum* were obtained from the Missouri plants. All the species were pathogenic in inoculation experiments through the soil to the begonia varieties mentioned.

FERRARIS (T.). **L'avvizzimento o tracheomicosi dell' Astro della China.** [Wilt or tracheomycosis of China Aster.]—*Riv. agric., Roma*, xxxiv, 788, pp. 287–288, 1938.

In this brief, popular note on the symptoms and control of wilt of China asters (*Callistephus chinensis*) due to *Fusarium conglutinans* var. *callistephi* [*R.A.M.*, xvii, p. 297], the author recommends that at transplanting all plants showing the least trace of infection in the region of the collar should be discarded and the remainder steeped from the roots to the collar in a solution of iron sulphate (1 per cent.) plus slaked lime for 15 to 30 minutes. The soil should be disinfected before planting by the addition of a finely ground mixture of quicklime and iron sulphate, or, better still, it should be treated with the complete fertilizer 'ferfor' (Caffaro) [ibid., xvii, p. 612] which rapidly suppresses soil-borne fungi.

KILLIAN (C.). **Le développement du Lasiobotrys lonicerae (Kunze).** [The development of *Lasiobotrys lonicerae* (Kunze).]—*Ann. Sci. nat., Bot.*, Sér. X, xx, 2, pp. 241–259, 30 figs., 1938.

A cytological study is fully described of the development of *Lasiobotrys lonicerae*, a subcuticular parasite found by the author on the leaves of *Lonicera nigra* in France.

HYNES (H. J.). **Gladiolus scab and its control.**—*Agric. Gaz. N.S.W.*, xlix, 9, pp. 484–486, 490, 3 figs., 1938.

The commonest disease of gladiolus in New South Wales is stated to be bacterial scab (*Bacterium marginatum*) [*R.A.M.*, xvi, p. 180]. The planting of healthy stock in infected land in July to September generally results in far heavier infection of the new corms than is the case when planting is done in November to February. This indicates a low temperature optimum for infection of the corms and cormlets. The disease is generally most severe under wet conditions.

Very satisfactory control results from immersion of the corms for 8 hours in mercuric chloride (4 oz. in 25 gals. water) or for 10 minutes

in the same with 2 pints of commercial hydrochloric acid added, or for 5 to 10 minutes in a suspension of mercurous chloride (1 oz. to each $1\frac{1}{2}$ pints water used). After any of these treatments the corms should be dried and stored in a dry, well-ventilated place until required. Crop rotation assists in control, and when treated corms must be planted in infected land, they should be planted between October and February, under the conditions prevailing locally. Five or six weeks after flowering has ceased, the plants should be dug and placed in a sheltered spot to dry off before separating the new corms for storage. All old trash should be burnt.

Elisei (F. G.). **L'Alternaria solani (Ell. et Mart.) Sorauer parassita delle foglie di Gerbera jamesoni Bolus.** [*Alternaria solani* (Ell. & Mart.) Sorauer, parasitic on the leaves of *Gerbera jamesoni* Bolus.] —*Atti Ist. bot. Univ. Pavia*, Ser. IVa, x, pp. 217–224, 5 figs., 1938. [Latin summary.]

During recent years nearly all the *Gerbera jamesoni* plants in the botanical gardens at Pavia have shown well-defined, reddish to wine-coloured, zonate spots on the leaf blades, and occasionally on the leaf stalks. When red, the spots shade off at the edge. They dry up from the centre towards the periphery, at the same time turning light, later dark, chestnut. At first they are only about 1 mm. in diameter, but enlarge to about 1 cm. and sometimes become confluent.

Conidiophores and conidia of a fungus identified as *Alternaria solani* were present on the spots. The conidia measured 50 to 80 by 10 to 15 μ, apart from the cylindrical, occasionally bifid or trifid appendage measuring 50 to 200 by 2 to 3 μ. The fungus was successfully isolated [but no inoculations are reported].

Elisei (F. G.). **Sopra una nuova varietà di Cercospora decolor Pass. (var. macrospora El.) e sull' Ascochyta boehmeriae Woron. in Italia.** [On a new variety of *Cercospora decolor* Pass. (var. *macrospora* El.) and on *Ascochyta boehmeriae* Woronich. in Italy.]—*Atti Ist. bot. Univ. Pavia*, Ser. IVa, x, pp. 225–231, 3 figs., 1938. [Latin summary.]

The first part of this paper deals with a leaf spot on *Martynia lutea* growing in the botanical gardens at Pavia caused by a new variety of *Cercospora decolor* named var. *macrospora* Elisei [with a Latin diagnosis].

The second part refers to a leaf spot of *Boehmeria nivea* observed in the summer and autumn of 1937 on plants growing at Pavia. The dark, fuliginous, sometimes rather ashy, irregular or almost circular, zonate spots over 2 cm. in diameter, bore subepidermal, yellowish, ostiolate pycnidia measuring 85 to 130 μ in diameter at the base. Each pycnidium produced numerous hyaline, almost cylindrical conidia, rounded at the ends, mostly with one median septum, occasionally with two or three transverse septa, and measuring 7 to 12 by 2·5 to 3·5 μ. The fungus is considered to be *Ascochyta boehmeriae* Woronichin (1924) [*R.A.M.*, iv, p. 245], with which *A. boehmeriae* Watanabe (1935) [ibid., xiv, p. 512] is probably synonymous.

Rodionova (Mme S. M.). Зараженность семян Клевера и результаты испытания протравителей. [Infection of Clover seeds and results of testing disinfectants.]—*Pl. Prot., Leningr., 1938*, 16, pp. 114–118, 1938.

A laboratory analysis of 24 samples of seeds of red, white, and Swedish clover [*Trifolium pratense, T. repens*, and *T. hybridum*] from several communal farms in northern U.S.S.R. showed that an average of 62·4 to 99 per cent. of the seeds were infected, from 0·6 to 52 per cent. by bacteria [unspecified], from 0 to 32·6 per cent. by species of *Fusarium* [unspecified], and from 25·5 to 98 per cent. by moulds (chiefly *Mucor* and *Alternaria*). Disinfection with potassium permanganate considerably reduced but did not eliminate infection, indicating that some of the organisms are carried internally. The infected seeds showed poor germination (30 per cent.) and their dry weight was only 71·2 per cent. of that of healthy seeds. Of the fungicides tested in the laboratory the best results were obtained with mercurized aniline (meranin) [*R.A.M.*, xvii, p. 440], dry (2 kg. per ton) or wet (1 in 500 for one hour), which reduced the infection in red clover from 98 per cent. in the control to 0·3 and 9·8 per cent., respectively, and raised the rate of germination from 39 per cent. in the control to 75·8 and 86·3 per cent., respectively; similar good results were obtained with white and Swedish clovers. The next best results were given by granosan, while nivarsin, talcarsin, and calcium hypochlorite reduced the incidence of infection by 33 to 69 per cent. and did not impede germination.

Minyaeva (Mme O.). О диагностических признаках и распространении цветочной плесени красного Клевера. [Diagnostic characters of the anther mould of Red Clover and its distribution within the host.]—*Pl. Prot., Leningr., 1938*, 16, pp. 110–113, 1938.

A comparative study on the anther mould of red clover [*Trifolium pratense*] caused by *Botrytis anthophila* [*R.A.M.*, xvii, p. 440] showed that diseased plants are of the same height as healthy ones, but lighter in weight and with fewer stems and heads. The colour of the heads cannot serve as a diagnostic character as pale-coloured heads occur both in diseased and healthy plants, and the disease can only be recognized with certainty from the typical grey colouring of the anthers, the opening of two or three flowers and two or three buds from the same head being considered necessary for a reliable diagnosis. Anatomical analysis of the seeds from diseased plants revealed a greater percentage of infected seeds than indicated by the biological method, and showed that in the case of primary infection developing from infected seed the mycelium is present in all parts of the plant, often forming coils in the cells of stems and flower stalks. In infected seeds the mycelium can be best detected in sections cut parallel to the cotyledons, where it can be seen in the parenchyma tissue under the seed coat and especially near the future radicle. It can only be seen after thorough staining and differs from the mycelium in other parts of the plant by the hyphae being slightly thicker and sometimes forming thick-walled bodies, possibly a resting stage of the fungus. The amount of mycelium present varies, being largest in the poorly developed, brown seeds. In the case of secondary infection in the field the attack is confined to the

flower, and in artificial inoculations of the stem the fungus remained localized, rarely penetrating into the deeper layers of tissue.

Richter (H.). **Lupinenkrankheiten.** [Lupin diseases.]—*Mitt. biol. Anst.* (*Reichsanst.*), *Berl.*, 58, pp. 87–101, 18 figs., 1938.

A semi-popular account is given of the principal diseases affecting lupins in Germany, namely, foot rot (*Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xv, pp. 101, 586], *Thielavia* [*Thielaviopsis*] *basicola* [ibid., xvii, p. 115], and in all probability *Pythium* spp.); wilt (*Fusarium oxysporum*), occurring on *Lupinus luteus* only; stem-browning, due to a virus [ibid., xvi, p. 680]; leaf fall (*Macrosporium* [*Stemphylium*] *sarcinaeforme*) [ibid., xvii, p. 185 and below, p. 141] (only on *L. angustifolius* both in nature and inoculation experiments); brown spot (*Ceratophorum setosum*) [ibid., xvii, p. 824], chiefly attacking *L. albus*; and two macroscopically indistinguishable rusts (*Uromyces renovatus* [ibid., vi, p. 732; xvi, p. 207] and *U. lupinicolus*), the former characterized by uredospores averaging 22·3 by 21·2 (19 to 26 by 18 to 24) [misprinted as '21' in original] μ, and teleutospores 20·2 by 17·6 (18 to 24 by 15 to 21) μ, while the corresponding dimensions of the latter are 23 by 19 (19 to 27 by 15 to 23) μ and 20·9 by 16·2 (14 to 35 by 13 to 22) μ.

Kidd (F.) & West (C.). **Spotting and other effects on Apples in storage due to volatile products from ripe Apples of other varieties stored with them.**—*J. Pomol.*, xvi, 3, pp. 274–279, 5 pl., 1 graph, 1938.

In order to study certain disorders which have been previously observed to occur when ripe apples were stored together with later maturing apple varieties, the authors placed the test varieties Bramley's Seedling, King Edward VII, and Laxton's Superb in pre-climacteric condition in store with ripe Worcester Pearmain and James Grieve. The storage temperature was 39° F. In parallel series of experiments fruit was stored in air (artificially mixed gases) and in gas (10 per cent. carbon dioxide+10 per cent. oxygen+80 per cent. nitrogen) in gas-tight metal cabinets through which the gas mixtures were passed at a rate sufficient to prevent any appreciable rise in the concentration of carbon dioxide. For each experiment three cabinets were used, the first containing trays of test varieties alone, the second trays of test varieties alternating with trays of Worcester Pearmain, and the third trays of test varieties alternating with trays of James Grieve. Furthermore, the fruit was partly unwrapped or wrapped in oiled paper. Included in the series with fruit stored in gas was also a test of the effect of ethylene, added to the storage atmosphere for three weeks at a rate of 1 part in 500. All fruit was removed from storage about four months later and the examination revealed the following results. Bramley's Seedling showed severe lenticel spotting [*R.A.M.*, x, p. 467] in the cabinets containing either of the two ripe varieties, Worcester Pearmain apples causing a more pronounced spotting than James Grieve, while the control apples in air and in gas were practically free from this kind of injury. The wrapped fruit suffered less than unwrapped. Bramley's Seedling treated with ethylene showed severe spotting identical in appearance with that caused by the presence of the ripe fruit, but oiled wrappers made no

difference. Essentially similar results were obtained with Laxton's Superb, in which case both ripe varieties were equally injurious. No spotting developed on the variety King Edward VII under any of the storage conditions tested. At the end of the experiment the two ripe varieties were naturally overripe but showed few or no signs of spotting. The small amount of superficial scald [loc. cit.] which developed on Bramley's Seedling under gas but not under air storage conditions was not in any way influenced by the presence of the ripe apples or ethylene. Considering the fact that ethylene and the vapours from ripe apples produced the same spotting on stored fruit and that it may be assumed from the results of recent research by Gane (*J. Pomol.*, xiii, p. 35, 1935) that the vapours of ripe apples contain ethylene, the authors are inclined to conclude that the spotting was due in both cases to the presence of this gas.

ASKEW (H. O.), THOMSON (R. H. K.), & CHITTENDEN (E.). **Effect of borax top-dressing on boron status of soil and fruit.**—*N.Z. J. Sci. Tech.*, A, xx, 2, pp. 74–78, 1938.

Continuing their studies [*R.A.M.*, xvi, pp. 186, 687; xvii, p. 462] on the effect of borax, used as a top-dressing for the control of internal cork of apples [ibid., xvii, p. 690], on the boron status of certain New Zealand (Nelson district) soils and apple varieties, the writers found that surface applications of borax (50 and 100 lb. per acre) penetrated the soil to a depth of at least 30 in. during the three-season period of the trials (from September, 1935, to March, 1938), at the end of which the boron content of the soil in the main root zone was maintained at a level at least twice as high as that of the control areas. In each of the three seasons the boron content of the fruit from the top-dressed areas was substantially higher than that of the controls. For instance, in 1938 the boron contents (p.p.m.) of Delicious, Sturmer, and Ballarat apples receiving 50 lb. borax per acre (one application) were 29·5, 31·0, and 23·0 as compared with 17·0, 24·0, and 9·0, respectively, for the untreated controls; in 1937, Jonathans given 100 lb. per acre contained 17·3 p.p.m. boron as against 9·8 untreated, while in 1936, 1937, and 1938 Dougherty supplied with borax at the rate of ½ lb. per tree contained 15·1, 12·0, and 10·5 p.p.m., respectively, the contents of the controls being only 3·9, 4·1, and 6·0, respectively. In view of the heavy loss of borax from the soil by leaching out (a year after treatment the content in the top soil was reduced to about one-tenth of that present immediately after dressing), small annual applications may well prove more economical than the relatively heavy periodical doses used in these investigations.

ATKINSON (J. D.). **Residual effect of boron soil dressings on internal cork of Apples.**—*N.Z. J. Sci. Tech.*, A, xx, 2, pp. 90–91, 1938.

Recent observations on plots of Sturmer and Washington apples treated against internal cork with borax and boric acid at the rates of ¼, ½, 1, 2, and 4 lb. per tree in the autumn of 1935 in the Nelson district of New Zealand [*R.A.M.*, xvi, p. 261 and preceding abstract] showed that the three smaller doses of the latter compound had lost much of their remedial action, especially on Sturmers. The effects of borax

were more lasting, even the ½ lb. rate giving practical control during the three years covered by the tests.

Atkinson (J. D.). **The effect of boron on bitter-pit of Apples.**—*N.Z. J. Sci. Tech.*, xix, 7, pp. 461–463, 1937.

Experiments on the control of bitter pit in the susceptible Cox's Orange apple [*R.A.M.*, xvii, p. 691] in the Nelson and Hawke's Bay districts of New Zealand in 1935 and 1936–7 by top-dressings of borax (¼ to 4 lb. per tree) and the injection of dilute solutions (2, 4, or 8 gm. in 2,000 c.c. water per tree) of borax, boric acid, and sodium perborate were unsuccessful, samples of both treated and untreated fruit showing 80 to 96 per cent. disease in the former year and 87 to 98 in the latter. These results are regarded as corroborating previous observations as to the different etiology of bitter pit [ibid., xvi, p. 262] and internal cork, the latter disorder responding by a marked improvement to boron treatments [see preceding abstracts].

Esbjerg (N.). **Forsøg med Opbevaring af Aebler. I. Foreløbig Beretning om Forsøg med forskellige Lagre, uden og med forskellig Nedkøling.** [Experiments in Apple storage. I. Preliminary report on experiments with different kinds of storage rooms, with and without different methods of cooling.]—*Tidsskr. Planteavl*, xliii, 2, pp. 310–336, 1938. [English summary.]

This is a fully tabulated account of experiments to determine the effect of storage conditions and cooling methods on the health of apples in Denmark. Both in 1936–7 and 1937–8 large fruits tended to develop more scald [*R.A.M.*, xvii, p. 691], Jonathan spot [ibid., xvii, pp. 443, 463], bitter pit [see preceding abstract], and internal breakdown [ibid., xvii, pp. 399, 462] than smaller ones. The average incidence of scald in the eight varieties tested under nine different conditions was 6, 3·8, 1·3, 3·8, 2·5, 3·6, 19·2, 10·3, and 5·4 per cent., respectively, for (1) storage at 3·5°, (2) 2·5°, and (3) 1·5° C. (air renewed by ventilation twice weekly), (4) 2·5° (renewed air), (5) 2·5° (cooling delayed 10 days), (6) 2·5° (cooling delayed 20 days), (7) air-cooled storage, (8), the same preceded by 10 days' cooling at 2·5°, and (9) the same preceded by 20 days' cooling at 2·5°. Under the same nine conditions, the average incidence of Jonathan spot was 0·7, 0·5, 0·3, 0·5, 1·2, 5·3, 21·3, 11·6, and 6·1 per cent., respectively, that of bitter pit 4·1, 6·4, 8·4, 6·4, 3·8, 2, 2, 2·5, and 4·7 per cent., respectively, and that of internal breakdown 0·1, 0, 0·1, 0, 0·2, 0·2, 0, 0, and 0·1 per cent., respectively.

In 1936–7 the maximum incidence of fungal rots, e.g., *Gloeosporium album* [ibid., xvi, p. 820], *Botrytis cinerea, Penicillium*, and *Monilia* [*Sclerotinia*], was 5·4 per cent. in Codlin Springrove stored at 2·5° with 20 days' delay and the minimum (nil) in Pederstrup stored at the same temperature without delay. In 1937–8 the maximum of 6 per cent. occurred in Cox's Pomona stored at 2·5° after 20 days' delay and the minimum (0·2 per cent.) in Bellefleur de France at 1·5° with renewed ventilation.

The highest average percentage (91·8) of flawless fruits was found in the consignment stored at 2·5° after 10 days' delay.

Weber (Anna). **Aeblesygdomme i Lagerrum.** [Apple diseases in the storage room.]—*Tidsskr. Planteavl*, xliii, 2, pp. 337–345, 12 figs., 1938.

This is a description in popular terms of the following diseases liable to affect stored apples in Denmark [cf. preceding abstract]: bitter pit, Jonathan spot, scald, internal breakdown, kernel rot (including brown heart), scab (*Venturia inaequalis*), brown rot (*Monilia* [*Sclerotinia*] *fructigena*), *Gloeosporium album*, *Trichothecium roseum*, *Penicillium expansum* and other *P.* spp., and *Botrytis cinerea.*

Häusermann (Elsi) & Thomas (E. A.). **Über ein Russfleckenvorkommen auf Aepfeln in der Gegend von Zürich.** [On a soot spot infection of Apples in the Zürich district.]—*Ber. schweiz. bot. Ges.*, xlviii, pp. 325–328, 2 figs., 1938.

From brownish-black, extremely tenacious spots on Landsberg Rennet apples near Zürich the writers isolated *Cladosporium herbarum* [*R.A.M.*, x, p. 675] in pure culture, and inoculated three fruits each of Winter Citron, Bohn, and an undetermined variety by spraying with a suspension of the spores in 8 per cent. malt extract. Typical spots developed on all the treated fruits, but only on the areas covered by drops of the nutrient solution, and the authors conclude that extraneous impurities, such as honey-dew, are necessary for infection in nature. Scrupulous attention to the cleanliness of the fruit would thus appear to be an effective measure of control for these unsightly blemishes.

Oserkowsky (J.) & Thomas (H. E.). **Exanthema in Pear, and copper deficiency.**—*Plant Physiol.*, xiii, 3, pp. 451–467, 4 figs., 1938.

Exanthema of Bartlett pear trees in central California [*R.A.M.*, xiii, p. 172] starts in late May or early June as a brown discoloration and necrosis of the extreme tips of the shoots and terminal leaves. The dying-off progresses downwards during the season and by the end of the summer three-quarters or more of the current year's growth may be killed. The dead leaves usually fall, leaving the shoots entirely denuded. The same process is repeated annually and may result in extreme degeneration or death. Diseased trees are liable to develop a dense, bushy habit, simulating witches' broom, in consequence of the stimulus to shoot growth from the axillary buds afforded by the death of the apical shoots. The bark of older branches is somewhat roughened due to a limited formation of excrescences. Affected trees bear practically no fruit. Foliar necrosis proceeds from the tip and margin towards the centre, the dead portion exhibiting alternate brown-orange striation running parallel with the outline of the leaf; this symptom is peculiar to pears, which do not, on the other hand, show typical chlorosis, though the green part of leaves with severe marginal burning may be slightly faded.

The copper content of leaves and shoots from trees in the affected area was found to be invariably lower (average 4 p.p.m.) than that from samples obtained in disease-free localities (minimum 10 p.p.m.). Effective control was secured by the incorporation of small doses of copper salts with the soil or their introduction into the root crowns, as well as by spraying with Bordeaux mixture. The response of the

trees to trunk treatments with copper sulphate, copper chloride, and copper nitrate was particularly rapid and striking, but a gradual improvement also followed injections of the less water-soluble copper carbonate, copper phosphate, and copper tartrate, and applications of copper sulphate crystals round diseased trees within a radius of a few feet from the trunk and incorporated in the top soil. The specifically remedial property of the copper salts in the correction of exanthema was demonstrated by the fact that similar treatments with those of other heavy elements were unavailing.

Hewitt (W. B.) & Leach (L. D.). **Species of Sclerotinia causing brown rot of deciduous fruits in California and their distribution.**—Abs. in *Phytopathology*, xxviii, 9, p. 670, 1938.

Of recent years brown rot, formerly largely confined to blossom- and twig-blighting of apricots, almonds, cherries, and prunes, has been much in evidence on peach fruit in the interior valleys of California. On 3rd March, 1936, apothecia of *Sclerotinia fructicola* [*R.A.M.*, xv, p. 592; xvii, p. 256] were found developing from mummified peach fruits in the upper Sacramento Valley, apparently for the first time in the State. *S. fructicola* was compared with cultures isolated from blighted apricot twigs and found to be distinct, the fungus attacking the latter host being identified as *S. laxa* [ibid., xvii, p. 687]. These are the only two species of *Sclerotinia* so far revealed by a survey of the stone fruit-growing districts of California.

Wilson (E. E.) & Serr (E. F.). **Preliminary tests to determine effect of arsenite sprays on sporodochia of Sclerotinia laxa and on control of brown rot in blossoms of Almond and Apricot.**—*Phytopathology*, xxviii, 10, pp. 759–760, 1938.

In preliminary tests in California the application to apricot trees, after the appearance of the 'sporodochia' of *Sclerotinia laxa* [see preceding abstract], of sodium arsenite at the rate of 1 lb. in 100 gals. water substantially reduced the germination of the conidia and largely prevented blossom infection. Monocalcium arsenite (4 in 100) plus 4 per cent. of a dormant type petroleum oil emulsion, applied to almond trees before the development of the sporodochia, suppressed their formation to the extent of 96 per cent. and reduced the incidence of blossom infection by 80 per cent., but when the treatment was carried out after the production of the sporodochia the germinability of the conidia was reduced by 97 per cent. and blossom infection by 71 per cent. Zinc arsenite (4 in 100), with or without 4 per cent. oil emulsion, was less effective than the foregoing in preventing the development of conidia, but when applied after their formation at the rate of 3 in 100, it reduced their germinability and the incidence of blossom infection by 90 and 83 per cent., respectively.

Fikry (A.). **The control of Peach mildew.**—*Bull. Minist. Agric. Egypt* 183, 14 pp., 7 pl. (1 col.), 1937. [Received November, 1938.]

Peach trees growing in all kinds of soils in Upper and Lower Egypt are stated to suffer from severe attacks of powdery mildew (*Sphaerotheca pannosa* var. *persicae*) [cf. above, p. 90], one of the most destructive and economically important diseases of the peach in Egypt.

Severity of attack is favoured by a high subsoil water-table, which weakens the trees, by salinity, poor drainage, impermeability, and water-logging of the soil, and by close planting of the trees. Large-scale experiments showed that proprietary and especially home-made lime-sulphur 1 in 10 (preferably with soap, 0·2 to 0·5 per cent.) and amberene [*R.A.M.*, xv, p. 761] 1 to 2 per mille (also with soap) were the best of the fungicides tested in controlling peach mildew on both the fruits and the foliage without causing damage to trees. Bordeaux and Burgundy mixtures gave satisfactory control of the disease on the leaves but not on the fruits. The first application should be made immediately after the outbreak of the disease, and it is usually necessary to apply two more sprays at intervals of three weeks. It was found in the course of these trials that amberene (2 per mille) with soap (4 per mille) also controlled aphids, and should these results be confirmed in further tests great economy of cost and labour could be achieved by the combined action of this fungicide.

Adam (D. B.). **A progress report on a gummosis (dieback) disease in South Australian Apricot trees.**—*J. Dep. Agric. S. Aust.*, xlii, 1, pp. 14–29, 9 figs., 1938.

Further investigations into apricot gummosis associated with a species of *Cytosporina* in South Australia [*R.A.M.*, xvi, p. 516] showed that in advanced infections the death of an affected limb occurs with great suddenness. An apparently healthy, though in reality badly affected, branch may wilt completely in a week, such wilting usually taking place when the tree is growing vigorously and the fruit is half formed. If infection occurs near the top of the tree in two- to three-year-old wood, the branch may wither 15 to 18 months later; if, however, infection occurs near the butt, many years may pass before sudden collapse. In many instances, the lowest point of penetration of the fungus in the wood is not indicated by any external symptom. After some time small, flattened pycnidia generally form just beneath the periderm, or occasionally on the wood where a dead branch has been cut off.

Inoculations with the mycelium or spore suspensions of the fungus isolated from diseased material into wounded apricot trees of different varieties gave positive results in over 50 cases, the fungus being re-isolated from the diseased area in a representative number of instances. Inoculations of uninjured bark gave negative results. The mycelium was a more effective inoculum than a spore suspension, but success also depended on the depth of the wound. The data showed that pruning cuts exposing a large section of wood provided a favourable site for infection; the fungus was also able to spread through deep bark wounds or the cut ends of smaller branches. None of the varieties commonly grown in South Australia appeared to be immune, but some, notably Tilton, showed resistance to infection by artificial inoculation.

It is considered that some modification in the pruning methods in vogue locally may possibly afford a means of control, while tests of winter sprays are also in progress. A common fault in treating affected trees is the failure to cut low enough to eliminate the disease.

[This paper also appeared in *Fruit World, Melbourne*, xxxix, 9, p. 22; 10, pp. 29–30, 35, 1938.]

WORMALD (H.). **Bacterial diseases of stone fruit trees in Britain. VII. The organisms causing bacterial diseases in sweet Cherries.**—*J. Pomol.*, xvi, 3, pp. 280–290, 2 pl., 1938.

In further experiments with *Pseudomonas prunicola* and *P. mors-prunorum*, the causal agents of bacteriosis of cherries [*R.A.M.*, xvi, p. 691], about 80 isolations were made from cankers on stems, branches, and twigs, lesions on young shoots, dead buds, and leaf and fruit spots of cherry trees. The two bacteria were readily distinguished by the following methods. From plates of nutrient agar with 5 per cent. saccharose, incubated for 48 hours at 25° C., the colonies of the two organisms were transferred to nutrient broth containing 5 per cent. saccharose and examined by reflected light against a dark background. The cultures of *P. prunicola* had a slight yellowish tinge and were more or less translucent, while those of *P. mors-prunorum* were white and somewhat opalescent. In the longevity test transfers of *P. prunicola* from six-day-old cultures on nutrient agar with 5 per cent. saccharose incubated at 25° to nutrient broth resulted in visible growth within one or two days, whereas transfers of *P. mors-prunorum* produced no growth since the organism was clearly dead. In a further test cultures on nutrient agar containing 2 per cent. lactose and bromo-cresol-purple as indicator, the initial alkaline reaction persisted in cultures of *P. prunicola* but in those of *P. mors-prunorum* the reaction became reversed.

In controlled inoculation experiments about 30 of the strains isolated produced definite lesions on the leaves, shoots, branches, and stems of the cherry trees; 15 of the most successful experiments carried out at various times between 1925 and 1932 are described in detail. Strains of both bacteria isolated from lesions on various parts of the cherry tree were able to infect other parts. The organisms pass the winter and spring in the stems and branches, producing lesions from which cankers develop during the summer. The bacteria within these cankers die out in summer, but meanwhile the leaves become infected and carry the organisms over in leaf spots until the autumn, when they again infect the branches and stems. In cross-inoculation experiments, generally speaking, strains of both bacteria isolated from plum [ibid., xvii, p. 693] proved to be more virulent on their own host than on cherry, while those derived from cherry were more injurious to cherry than to plum. The negative and inconclusive results of some of the experiments indicate that the degree of infection following inoculation is greatly influenced by the physiological condition of the tree. The conditions favouring or checking infection of the branches and stems have not yet been determined, but the infection of leaves and shoots seems to be undoubtedly favoured by wet weather.

ROOS (K.). **Das Kirschbaumsterben im Baselland. 1. Mitteilung: die Erscheinungsformen der Krankheit.** [The dying of Cherry trees in the Basle district. Note 1: the symptoms of the disease.]—*Landw. Jb. Schweiz*, lii, 5, pp. 596–617, 33 figs., 2 graphs, 1 map, 1938. [French summary.]

The present paper is the outcome of investigations undertaken by the Wädenswil Experiment Station into a new serious disease of cherry

trees, which occurs in many communities of the canton of Basle (but not in the higher districts), and especially in Aesch and Pfeffingen, where the disease first appeared about 1890 and has since considerably reduced the cherry orchards, though these still form one of the chief sources of income for the inhabitants. A survey of 4,282 cherry trees in the Aesch-Pfeffingen district revealed the presence of 82 per cent. healthy, 7 per cent. doubtfully infected, and 11 per cent. diseased trees. The local growers believe the disease to be infectious, since it spreads noticeably directly after regeneration. During the winter the young shoots of diseased trees measure only a few centimetres, the buds are closely aggregated, and in extreme cases the length of a diseased shoot with 32 buds equals the distance between two buds in a normal shoot. In the spring the young shoots appear light brown from a distance, their growth is arrested at the beginning of vegetation, so that they need about 14 days more for the first signs of growth and 14 days longer to reach the blossoming stage than those of a healthy tree. The leaves are shorter, narrower, and more pointed than healthy ones and often develop a dark green callus growth on their lower surface. The fruits are smaller, elongated, grow on short fruit stalks, and usually fall in June. At the normal time of ripening the diseased fruits are green with red spots and have no flavour. Some ripen later and become abnormally large but remain poor and watery in taste. The disease usually begins with the appearance of the typical pointed leaves on one of the branches, spreading farther each year. Often healthy and diseased parts are found on the same branch or even shoot. The cause of the disease has not yet been determined.

BAIN (H. F.) & DEMAREE (J. B.). **Isolation of the fungus causing the red stele or red core disease of Strawberries.**—*Science*, N.S., lxxxviii, 2276, pp. 151–152, 1938.

In November, 1937, some 50 per cent. of a number of washed, decorticated pieces of strawberry roots affected by the red stele or red core disease [*R.A.M.*, xvii, p. 759] in Maryland yielded a species of *Phytophthora* in pure culture on water agar, which was, however, only obtained from 4 out of 45 isolations made by H. W. Anderson in Illinois in March, 1938, the remainder giving rise to a *Pythium* evidently following closely on the *Phytophthora*.

Under greenhouse conditions inoculation of the roots with a zoospore suspension of the latter fungus caused wilting in three weeks, by which time the root systems were almost entirely destroyed, showing the typical symptoms of natural infection. The organism was recovered in pure culture from the reddened steles of the larger roots. Uninoculated control plants remained healthy.

The exact identity of the strawberry *Phytophthora* is still under investigation: at present it can only be placed in the group characterized by larger non-papillate sporangia, relatively large oospores, and predominantly amphigynous antheridia. Oatmeal agar and canned pea broth are the best of the media tested, somewhat less rapid growth being made on Lima bean agar. Sporangia and zoospores develop in profusion on small blocks of mycelium grown in thin layers of Lima bean agar under shallow irrigation with cool tap water. The temperature

range of the fungus is comparatively low; the mycelium is killed in a week at 30° C. and zoospores are produced at 10° but inhibited at 22°, the optimum for development extending from 14° to 18°. Zoospore dispersal, together with mechanical distribution of diseased plant material, constitutes the main agency of spread of infection in the field.

The zoospore and sporangial dimensions of the American red stele organism fall well within the range reported for the *Phytophthora* [allied to *P. cinnamomi*] associated with the Lanarkshire disease in Scotland, and since the symptoms are largely similar, the two disorders may well be identical.

Ferrer (R. B.). **El control de la 'Sigatoka' del Banano.** [The control of 'Sigatoka' of the Banana.]—*Bol. Coop. Banan. Magdalena Lim., Colombia, 1938,* 7–8, pp. 7–19, 14 figs., 1938.

This is a full discussion of the economic, technical, and practical aspects of the control of 'Sigatoka' disease of bananas (*Cercospora musae*) [*R.A.M.*, xvii, p. 760] in Mexico [ibid., xvii, p. 720], Honduras [ibid., xvi, p. 195], Guatemala, and Colombia, with reference in each case to local conditions and requirements. Spraying with 5–5–50 Bordeaux mixture or 20–80 copper-lime dust is generally recommended.

Alvarado (J. A.). **¿Es la sigatoka una enfermedad susceptible de curarse por sí sola y sin tratamiento alguno?** [Is 'sigatoka' a disease susceptible of spontaneous cure without any treatment?]—*Rev. Agric., Guatemala,* xv, 4, pp. 214–220, 1938.

The writer advocates a strenuous campaign for the eradication of 'sigatoka' disease of bananas (*Cercospora musae*) which has now appeared in Guatemala [see preceding abstract].

Briant (A. K.). **Report on the Agricultural Department, St. Vincent, for the year ended December 31st, 1937.**—43 pp., 1938.

Cercospora disease of bananas [*C. musae*: see preceding abstract] was first recorded in St. Vincent in September, 1937, from an estate on the Leeward Coast. Since then it has been found on another estate farther north. The affected areas are not extensive, and only slight damage was caused. Control by burning all infected material is being attempted.

Pollacci (G.), Ciferri (R.), & Gallotti (M.). **Lo zolfo colloidale come preventivo contro le alterazioni dei caschi di Banana.** [Colloidal sulphur as a preventive of injuries to Banana bunches.]—*Atti Ist. bot. Univ. Pavia,* Ser. IVa, x, pp. 257–264, 1938. [Latin and English summaries.]

In experiments carried out in Italy on the prevention of loss (mostly due to *Gloeosporium musarum*) in bananas [*R.A.M.*, xviii, p. 41] dispatched from Italian Somaliland it was found that treatment of the cut surfaces of the rachis, by sprinkling with quicklime or hydrated lime before inoculation with *G. musarum* and incubation at 20° to 25° C. in a saturated atmosphere, resulted in slight retardation of infection only. Sprinkling the cut surfaces before or after inoculation with Caffaro powder and dipping the pieces in Bordeaux mixture (1 and 2 per cent.) gave somewhat better results. Painting the surfaces

with colloidal sulphur immediately after inoculation by sprinkling with a spore suspension of the fungus, or after an interval of from 1 to 24 hours, showed that the treatment was most effective when carried out within 2 hours of inoculation. When carried out after 3 hours, it was less effective, and after 8 to 10 it was practically useless.

When whole bunches sprayed with a suspension of the fungus and allowed to dry were dipped for a few seconds in suspensions of colloidal sulphur at various concentrations, the lowest concentration preventing rotting was about 10 kg. per hectol. water. It is recommended that in addition to this treatment the cut ends of the main stalks should be painted with undiluted colloidal sulphur paste. In extensive tests carried out in Italian Somaliland painting the cut ends in this manner gave good control of wastage on arrival in Italy as compared with no treatment and treatment with Caffaro powder, quicklime, and hydrated lime.

ANAGNOSTOPOULOS (P. T.). *Μία νέα ζημία τῶν καρπῶν τῆς φιστικιᾶς (ὑπὸ τοῦ μυκῆτος* **Phomopsis sp.**). [Damage to Pistachio fruits caused by the fungus *Phomopsis* sp.]—*Hort. Res., Athens, 1938*, 3, pp. 551–558, 3 figs., 1938. [English summary.]

Pistachio nut (*Pistacia vera*) drupes are stated to suffer heavy damage in Greece from a species of *Phomopsis*, which is active in the spring and autumn, when temperatures below 25° C. and a relative humidity above 55 per cent. prevail. *Tinea pistaciae* acts as a precursor of the disease and other insects aid in its dissemination. Control measures should include the extermination of the insect vectors, destruction of diseased fruits, twigs, and foliage, and preventive treatments with 2–2–100 Bordeaux mixture.

SIMMONDS (J. H.). **Plant diseases and their control.** *ex* **The Queensland agricultural and pastoral handbook. Vol. iii.**—pp. 117–254, 4 pl., 44 figs., Brisbane, David Whyte, Government Printer, 1938.

Part ii of this handbook follows the same general lines as in the older publication 'Pests and diseases of Queensland fruit and vegetables' [*R.A.M.*, viii, p. 660], but the text is considerably enlarged to include most of the common diseases affecting the more important economic hosts and additional information is incorporated to bring the whole up to date. The final chapter deals with the preparation and use of the common fungicides.

STEVENS (N. E.). **Departures from ordinary methods in controlling plant diseases.**—*Bot. Rev.*, iv, 8, pp. 429–445, 1938.

The writer summarizes, with brief explanatory notes, a number of recent examples of plant disease control by newly devised methods based on increasing knowledge of the biological relationships between host and pathogenic agency. Most of the work referred to has been noticed in this *Review* from time to time.

SALAMAN (R. N.). **A discussion on new aspects of virus disease.**—*Proc. roy. Soc.*, Ser. B., cxxv, 840, pp. 291–310, 1938.

In an opening address R. N. Salaman deals with the properties of the six distinct strains of the potato virus X isolated by him in pure

plant cultures, and describes their respective reactions on tobacco and potato, explaining the observed differences by the presence of certain radicles in the virus particles [see below, p. 129]. These hypothetical radicles are linked up with certain serological reactions, radicle 'A' being identified with the flocculating antigen, common to all strains, and radicle 'M' being equated with the neutralizing antigen.

K. M. Smith and W. D. MacClement suggest that the variability in size of virus particles calculated by means of ultrafiltration is due to aggregation of particles after precipitation. They have succeeded, however, in breaking down the aggregates of *Nicotiana* virus 11 (tobacco necrosis virus) by dialysing the virus against tap or distilled water either before or after precipitation, and have consequently obtained the same filtration end point of 45 mμ for both the precipitated and the unprecipitated virus.

F. C. Bawden states that all the viruses so far isolated have some degree of crystallinity, which varies with the different viruses and in some cases with the medium containing the virus.

J. D. Bernal draws the conclusion from his X-ray studies with the tobacco mosaic, cucumber mosaic, potato X, and bushy stunt viruses that the virus particles in the plant consist of flat prismatic protein molecules which attach themselves together very readily in the form of elongated piles, giving rise in this state to liquid crystal phenomena and being amenable to X-ray examination [ibid., xviii, p. 45].

A. S. McFarlane's observations of the virus of vaccinia favour the conception of the virus as a large inert protein particle.

G. M. Findlay expresses the view that certain variations of animal viruses are reversible alterations of the hereditary constitution caused by environmental changes, while others appear similar to the mutations of higher animals and plants.

Marion A. Watson discusses the aphid transmission of some plant viruses and compares the methods of determining the infectivity of the viruses by the starch lesion count and by their transmissibility by the vectors.

P. A. Murphy sums up the practical aspects of virus research for the control of plant diseases and considers protective inoculation with weak virus strains against attacks of more virulent viruses to be potentially dangerous, and the complete absence of all viruses, which appears not unattainable in the light of recent work, to be the more desirable aim.

W. J. Elford suggests that an investigation of the influence exercised by the medium on the dispersion and adsorbability of plant viruses may reveal conditions that are more favourable for filtration than are those obtaining in plant juice.

JAEGER (F. M.). **De analytische ultra-centrifuge en het onderzoek der filtreerbare virus-soorten.** [The analytical ultra-centrifuge in the study of filterable virus types.]—*Chem. Weekbl.*, xxxv, 23, pp. 419–431, 6 figs., 5 diags., 8 graphs, 1938.

This is a highly technical discussion of the theoretical principles and practical applications of the ultracentrifuge to the study of filterable viruses, especially crystalline proteins, such as tobacco mosaic.

MAXIMOV (N. A.). **Plant physiology.**—xxii+473 pp., 132 figs., 12 graphs, London, McGraw-Hill Publishing Company, Ltd., 1938. 25*s*.

This, the second English edition of this work, is a translation and revision made from the fifth Russian edition, and is a completely new book, bringing up to date the results of plant physiological research throughout the world. The work includes a short section (pp. 382–387) dealing with the resistance of plants to fungi, the interrelations of parasite and host, and immunity.

VERONA (O.). **L'alimentazione minerale dei vegetali in rapporto al loro stato di sanità.** [The mineral nutrition of plants in relation to their state of health.]—263 pp., 27 figs., 8 graphs, Pisa, Arti Grafiche Tornar, 1938. L. 40.

In this work the author succinctly reviews and discusses the results of the most important recent research work on the effect of mineral nutrition on plant health, with particular reference to mineral deficiency and excess as affecting yield and susceptibility to disease, including fungal infection. Ten chapters are devoted to the metalloids, and fourteen to the metals. The bibliography extends to 58 pages.

FEDOTOVA (Mme T. I.). Серологический метод в определении сортоустойчивости растений к заболеваниям. [The serological method of determining the varietal resistance of plants to disease.] —*Pl. Prot., Leningr., 1938*, 16, pp. 50–58, 1938.

In further studies on the estimation of the resistance of cotton to *Verticillium dahliae* by the serological method [*R.A.M.*, xv, p. 577; xvii, p. 438], the data obtained from tests on 150 samples from 125 strains of *Gossypium hirsutum*, *G. herbaceum*, and *G. barbadense* agreed in 80 per cent. of cases with the data from field trials. None of the deviations was great, but sometimes strains known from the field trial to be very susceptible or only slightly susceptible were placed in the moderately susceptible group. Isolations of *V. dahliae* from cotton and other plants, but grown on the same culture medium for a year, showed differences, sometimes marked, in the serological reactions induced by the susceptible and resistant strains of cotton.

The resistance of 17 strains of *Phaseolus vulgaris*, *P. acutifolius*, and *P. aureus* to *Bacterium phaseoli* [ibid., xvii, p. 720] was tested by the same method and the results obtained again agreed closely with the data from field trials. It was extremely difficult to obtain reliable field data for this disease and for *Bact. medicaginis* var. *phaseolicola* [loc. cit.] and *Bact. phaseoli* var. *fuscans* [ibid., xvi, p. 85], as they usually occur together, but serological tests indicate that bean varieties have different degrees of resistance to each of the three diseases.

The reliability of the serological method was further confirmed in testing the resistance of 16 strains of flax (*Linum usitatissimum* vars. *elongatum*, *intermedium*, and *multicauleum*) to *Melampsora lini* [ibid., xvii, pp. 441, 530], *Fusarium lini* [loc. cit.], *Colletotrichum lini* [ibid., xvi, p. 386], and *Polyspora lini* [see above, p. 111].

Isakova (Mme A. A.). Опыт применения метода Росси-Холодного к изучению бактериориз у различных растений. [Experimental application of the Rossi-Cholodny method for the study of bacteriorrhiza of various plants.]—*Bull. Acad. Sci. U.R.S.S., 1938*, Sér. biol., 2, pp. 517–522, 1 pl., 1938.

The Rossi-Cholodny method [*R.A.M.*, xvii, p. 554] proved very satisfactory in the author's study on the bacteriorrhiza of peas, lupin, mustard, oats, and wheat [cf. ibid., xvii, p. 303]. In addition to a microscopical examination of stained glass slides, however, cultures of the bacteria were isolated from the slides and grown on various nutrient media. The suitability of the media to the various bacteria [unidentified] is discussed and notes are added about the organisms isolated.

Yarwood (C. E.) & Childs (J. F. L.). **Some effects of rust infection on the dry weight of host tissues.**—*Phytopathology*, xxviii, 10, pp. 723–733, 1938.

The local dry weight per unit area of leaves infected by *Uromyces betae* on beet, *Tranzschelia punctata* [*Puccinia pruni-spinosae*: *R.A.M.*, xvii, p. 756] on prune, *U. phaseoli* [*U. appendiculatus*: ibid., xvii, p. 427; xviii, p. 48] on bean (*Phaseolus vulgaris*), *Puccinia iridis* [ibid., xvii, p. 397] on iris, *P. antirrhini* on *Antirrhinum majus*, *P. helianthi* [ibid., xvi, p. 539] on sunflower, *Phragmidium* sp. on rose, and two other rusts in California was greater than that of corresponding areas on healthy or lightly infected leaves, the differences ranging from —3·0 to +110·0 per cent., with an average of +33 per cent. Anomalous results were obtained in the case of *Melampsora* sp. on poplar.

In 14 tests with paired sunflower leaves or plants, the dry weight of the entire rusted leaves was from 2 to 46 per cent. greater than that of the paired controls. In three tests the green weight and proportion of dry matter of diseased leaves averaged 9 and 15 per cent. more, respectively, than in the case of healthy material.

The reduction in dry weight yield of entire sunflower and Pinto bean plants as a result of rust infection of the primary leaves was associated with a higher yield of diseased than of sound leaves, and lower stem and new growth yields from infected than from healthy plants. In three tests with beans and one with sunflowers, rust infection decreased the diurnal fluctuation in foliar dry weight.

Weindling (R.). **Association effects of fungi.**—*Bot. Rev.*, iv, 9, pp. 475–496, 1938.

In this review of recent investigations which throw light on the principles and mechanism of fungal association effects, emphasis is placed on work concerned with the stimulatory and toxic metabolic products of fungi. The main points dealt with include types of fungous associations, effects of association on morphology and physiology, metabolic products in association effects, substances present in parasitic Mucoraceae and sex responses in this group, accessory substances stimulating growth or sporulation, influence of variation in food supply and environmental conditions, and methods of study. A bibliography of 81 titles is appended.

Alexopoulos (C. J.), Arnett (R.), & McIntosh (A. V.). **Studies in antibiosis between bacteria and fungi.**—*Ohio J. Sci.*, xxxviii, 5, pp. 221–234, 2 pl., 2 graphs, 1938.

In investigations begun in October, 1935, to determine whether bacteria are able to inhibit the growth of fungi when grown in close association with them in culture, *Actinomyces albus* inhibited all the fungi against which it was tested (including *Glomerella cingulata*, *Physalospora cydoniae* [*P. obtusa*], *Gloeosporium musarum*, *Botrytis tulipae*, *Cephalothecium* [*Trichothecium*] *roseum*, *Colletotrichum lindemuthianum*, and *Volutella fructi* [*C. fructus*: *R.A.M.*, xvi, p. 543]) on dextrose agar and maize meal agar; *Bacillus subtilis* inhibited five out of the ten fungi on dextrose agar and eight on maize meal agar; and *Serratia marcescens* [*Bacterium prodigiosum*: ibid., xiii, p. 541] inhibited three fungi on dextrose agar and five on maize meal agar. None of the eight other bacteria exerted any appreciable effect on any fungus. The greatest single amount of inhibition was produced by *B. subtilis* on *T. roseum* on maize meal agar. In every case except one, inhibition, when occurring, was greater on maize meal agar than on dextrose agar. No correlation was established between rate of growth and degree of inhibition. Sterilized filtrates of cultures of *A. albus* produced similar inhibitory effects to those of the living organism. In tests on *C. lindemuthianum* neither food depletion of the medium nor a change in P_H value brought about by *A. albus* was responsible for the inhibition of growth and it would seem probable that the antibiotic phenomena noted are due to the presence of a toxin, which is soluble in water, diffusible through agar, and largely thermostable.

Lilly (V. G.). **Growth substances for fungi.**—*Bull. W. Va agric. Exp. Sta.*, Ser. 38, 3–11, pp. 95–103, 1937. [Abs. in *Exp. Sta. Rec.*, lxxix, 5, p. 175, 1938.]

Following a review of the pertinent literature data are presented showing that garden peas contain a growth-promoting substance for *Phytophthora cactorum* [cf. *R.A.M.*, xvi, p. 199]. In initial purification experiments this substance was found to be thermostable, insoluble in ether, ligroin, and methyl cellosolve, but soluble in alcohol, acetone, carbon tetrachloride, and benzene. The chemical nature of the substance remains to be investigated.

Salaman (R. N.). **The Potato virus 'X': its strains and reactions.**—*Philos. Trans. Roy. Soc.*, Ser. B., ccxxix, 559, pp. 137–217, 8 pl., 2 figs., 5 diags., 2 graphs, 1938.

In studies on potato virus X [see above, p. 126], the author has differentiated 6 strains of the virus based on the results of inoculation experiments with a wide range of plants, conducted under constant conditions of temperature (50° and 70° F.) and high humidity, the inoculum being obtained by punching (and then grinding up with tap water) circular disks of tissue, 4 or later 1 mm. in diameter, taken from the green and the yellow areas on leaves of an artificially infected tobacco plant. The virus originally came from a potato plant and had passed through *Datura stramonium* and then a series of five tobacco plants

before being used as inoculum. The first strain, designated X^H, produces a distinct reaction only on *Capsicum annuum*; on all other plants tested it is masked, but its presence, as demonstrated more than 100 times on over 1,000 plants, protects them from more virulent strains. This strain produces no lesions on tobacco and on only three potato varieties does it cause top necrosis. The mild or X^G strain produces no local lesions on either potato or tobacco, but occasionally a faint mottle on tobacco and a transient interveinal mottle on potato. The medium or X^L strain produces no local lesions on either host, but a yellow mottle, which later develops into a dark tortoise-shell pattern on tobacco, and a mild mottle on potato. The severe or X^S strain produces local lesions in form of rings with small necrotic centres on tobacco, and an interveinal mottle on potato. The X^D strain (Bawden's foliar necrosis) produces a necrotic spotting of the leaves in potato and no local lesions but a mild mottle in tobacco. Previous infection with a weaker strain of X virus protects both potato and tobacco plants against infection with X^D. The strain X^N produces a very severe necrotic mottle on tobacco and an interveinal necrosis on potato, similar to one produced by X^S, followed in most varieties by leaf drop. In the field potatoes are usually infected by two or more strains simultaneously, but single strain infections with X^H and X^N have been observed. Inclusion ('X') bodies, mostly granular and deeply staining but all much of the same character and larger than the nucleus of the cell (up to nearly twice as large), were found in all the six strains. They occurred most commonly in X^H and X^L and rarely in X^D. In raw unclarified juice at room temperature the strains X^H, X^D, X^S, and X^N remained viable for 4 months, and X^G and X^L for 5 months; the particle size was 113 $\mu\mu$ for all six strains; the dilution end-point was 1 in 3,000 for X^H, 1 in 10,000 for X^G, X^L, and X^S, 1 in 5,000 for X^D, and 1 in 100,000 for X^N; and the thermal death point was 70° C. for X^N and 68° for all the other strains.

When plants were inoculated with mixtures of pure strains of the X virus *in vitro*, it was found that a sufficient amount of a mild strain protected the plant from the more virulent strains, thus X^L and X^S were completely masked when 9 and 5 times as much X^G, respectively, was used in the mixture. The intensity of reaction of a mixture of virus Y with any of the strains of virus X on tobacco was found to be in direct proportion to the virulence of the X strain used; similar but less intense and distinct reactions resulted from the mixture of the X strains with potato virus A and tobacco mosaic virus.

Conversion of strain X^S into X^L and X^G was effected by sap inoculations of tobacco and subsequent passages through several generations of the same host; conversion of X^S to X^G was further observed within a pure strain after passages through horse beans (*Vicia faba* var. *minor*), red beets, and sugar beets, and *in vitro* by mixing X^S infected tobacco juice with that of healthy sugar beet. All conversions have been from the more to the less virulent strain. They are believed to be true mutations.

Datura stramonium, tobacco, *Nicotiana glutinosa*, and potatoes artificially inoculated with X^G or X^H were resistant to subsequent inoculations with either X^L, X^S, X^N, or X^D, better protection being secured

when the plants (especially tobacco) were in active growth, so that the protective strain was distributed throughout the plant before inoculation with the virulent one, than in older plants and by allowing an interval between the two inoculations of not less than eight days. Successful protection was, however, readily obtained in older plants of *D. stramonium*. This protective action of mild against more virulent strains was specific to the X strains and was not effective in subsequent inoculations with virus Y and a few other viruses. When the protective virus has been introduced by inoculation in nine cases out of ten the plant is rendered completely immune from a later infection with a virulent strain and in the tenth case the virulent virus is restricted to isolated spots and does not become generalized.

The discovery of the masked X^H strain in certain potato stocks thought to be virus-free suggested that this strain may be present in these apparently healthy stocks. The protection afforded by it against the destructive and easily communicable viruses X^D and X^N indicates that the rarity of the latter in the field may be due to the presence of X^H. The author is convinced that protection of this type has been at work in the field for a long time. Tests of the seedling 41956, raised by the United States Department of Agriculture, showed that no masked strain of X was present and the very real immunity of this seedling from X is apparently of the kind found in the case of wart disease (*Synchytrium endobioticum*) and may be genetic in origin.

In an attempt to explain the phenomenon of protective inoculation the author suggests that such protection is due to a radicle designated 'A', common to all six X strains, which determines the attachment of the virus molecule to the plant protoplast and prevents the subsequent attachment of a second related strain. The reactions of the strains to host plants are also ascribed to radicles, 'M' being responsible for mottle production, 'N' inducing local and systemic necrosis, 'P' causing necrotic foliar lesions on potato only, and 'C', which is inert when alone, producing in company of a like radicle in tobacco mosaic a distinct and lightly necrotic mottle in tobacco. It is suggested that these radicles can be identified with various antigens, as it appears from the serological experiments undertaken by Bawden and Spooner that the strains of X virus have certain antigens in common and others peculiar to each strain. The author considers that an analogy may exist between the particles and the free genes of the cytoplasm rather than the nuclear genes.

SALAMAN (R. N.). **The fight against Potato disease.**—*J. Minist. Agric.*, xlv, 9, pp. 881–889, 1938.

The control of the two most destructive virus diseases of the potato in England, leaf roll and leaf drop streak (caused by virus Y) [*R.A.M.*, xvii, p. 833], lies in the removal of sources of infection (including the removal of infective foci, destruction of carriers other than potatoes, and roguing), the sowing of clean seed, the extermination of *Myzus persicae* [see next abstract], and the use of immune varieties for seed purposes.

The removal of infective foci involves adequate crop rotation and good cultivation to eliminate infected groundkeepers, and cessation of the practice of growing crippled stocks year after year. Solanaceous

weeds, particularly *Solanum nigrum* and *S. dulcamara*, of which the latter may be infected with leaf roll and the former with both X and Y potato viruses, must be completely excluded from potato-growing areas.

The prices of very high-quality, certified stocks of seed potatoes from Cumberland, Scotland, and Ireland are in many cases no higher than those of uncertified, diseased stocks. The supply of first-class potato seed in Great Britain is only about one-third or one-fourth of what it should be if the highest returns compatible with good farming and high wages are to be obtained.

No localities are completely free from *M. persicae*, but there are many wet, windy districts where it is very scarce, and the migration of the winged form is impeded. Heavy rain may relieve a potato crop from infestation for a considerable time, or for a whole season if the weather remains cold and damp. The removal of peach and apricot trees largely eliminates the winter-breeding sexual generation, while winter-spraying, if such removal is impracticable, will kill the sexual forms and eggs, and early nicotine spraying will destroy the winged form. Cruciferous weeds act as temporary hosts of the insect in the early spring and must be removed. As the aphids overwinter on winter cabbage and turnip, potatoes should not be grown near market-gardens. Large-scale tests with insecticidal sprays or deterrent dressings to destroy the aphids on the potatoes are required, but such treatment will probably prove too expensive to be practicable.

The development of immune varieties by planned genetic methods is being considered in England and the U.S.S.R., but does not appear to offer great promise. The only truly immune variety appears to be the American seedling 41,956. The author has produced acquired immunity from leaf drop streak, but the vaccine gave rise to an undesirable reaction. As regards the development of carrier varieties, there are at present none that is not adversely affected by leaf drop streak, but Ulster Monarch and Edgecote Purple may appear almost normal when chronically infected. The Swedish variety, Imperia, is a perfect carrier of leaf roll [ibid., vii, p. 596].

Heinze (K.) & Proeft (J.). **Zur Lebensgeschichte und Verbreitung der Blattlaus Myzus persicae (Sulz.) in Deutschland und ihre Bedeutung für die Verbreitung von Kartoffelviren.** [On the life-history and distribution of the aphid *Myzus persicae* (Sulz.) in Germany and its importance in the dissemination of Potato viruses.]—*Landw. Jb.*, lxxxvi, 3, pp. 483–500, 4 figs., 4 graphs, 1 map, 1938.

Attempts at the elimination of virus diseases from German potato stands have hitherto been concentrated mainly on the removal of infected material by roguing. In this paper the writers provide a fresh approach to the problem of control by a description of the life-history and distribution of the principal virus vector, the peach aphid (*Myzus persicae*) [*R.A.M.*, xvii, p. 265; xviii, p. 50] in the country. The control of the aphid by eradicating the commercially unimportant peach and apricot orchards in the vicinity of potato fields and by spraying is briefly discussed.

[A semi-popular account of this work by the first-named author appears in *Dtsch. landw. Pr.*, lxv, 46, pp. 591–592; 47, p. 602, 1938.]

Köhler (E.). **Die Bedeutung der Insekten für den Kartoffelabbau.** [The importance of insects in Potato degeneration.]—*Mitt. biol. Anst. (Reichsanst.), Berl.*, 58, pp. 29–36, 1 map, 1938.

After emphasizing the important part played by *Myzus persicae* in the transmission of virus diseases of the potato in Germany, and the consequent need for the drastic reduction or at least the effective insecticidal treatment of peach stands in the vicinity of production centres [see preceding abstract], the writer draws attention to the suspected implication of *Aphis rhamni* (*A. abbreviata*) in the dissemination of the A virus [cf. *R.A.M.*, x, p. 747; xiv, p. 496; xviii, p. 50]. Further investigations on this point are urgently required, while fuller knowledge of the migratory phases both of *M. persicae* and *A. rhamni* will facilitate insecticidal operations on the peach and the field spraying of potatoes [see next abstract].

Störmer. **Die praktische Bekämpfung der Viruskrankheiten bei der Kartoffel.** [The practical control of virus diseases in the Potato.]—*Mitt. biol. Anst. (Reichsanst.), Berl.*, 58, pp. 37–46, 4 figs., 1938.

For practical control purposes the virus diseases affecting the German potato crop may be divided into two groups, (1) comprising those transmitted by the peach aphid [*Myzus persicae*: see preceding abstracts], namely, leaf roll, streak, and the A virus, and (2) represented by the X viruses, the mode of transmission of which has not yet been elucidated [but see *R.A.M.*, xvii, p. 832], though it is in any case independent of *M. persicae*. Under the relatively dry climatic conditions prevailing in the vast potato-producing areas of north-east Germany, even thorough and repeated roguing does not achieve the unqualified success in virus elimination reported from Holland, and requires to be supplemented by other methods. The extension of peach cultivation not only necessitates the application of an insecticide to the trees during dormancy, but also the treatment of the potato crops with nicotine, which may well be combined with the routine programme for the control of *Phytophthora* [*infestans*] and *Alternaria* [*solani*]. In the Cologne district, where virus diseases are rife, completely healthy seed stocks of the susceptible Erstling [Duke of York] variety have been raised by these methods from original stocks of a high degree of purity, and both there and in the neighbourhood of Bonn Bordeaux mixture effectively combated the aphids without the addition of nicotine.

Early harvesting, before the virus has time to pass from the foliage to the tubers, is another method of control widely practised in Holland; there are, however, certain physiological drawbacks to this procedure, and attempts have been made to replace it by the destruction of the aerial organs with strong concentrations of copper sulphate. Experiments on similar lines, using carbolineum or sodium chlorate solution, are planned by the author. Berkner's method of late planting [ibid., xv, p. 457] did not give favourable results in the author's tests in 1937, the 1938 progeny of the July-sown seed being, in fact, much more severely infected, especially by leaf roll, than that of seed planted on the normal dates in April to May.

Experiments are now in progress to obtain disease-free material by isolating potato clones in the midst of cereals, each potato plant or

progeny from a single plant being separated from similar units by 3 m. of winter barley. The soil is treated with carbon disulphide (100 c.c. per sq. m.) and the potatoes alternately sprayed with Bordeaux mixture and a soapy extract of insect powder. So far the results appear to be promising.

WARTENBERG (H.). **Die Grundlagen der Methoden zur Pflanzgutwertbestimmung an Kartoffelknollen.** [The foundations of the methods for determining the value of Potato tubers as seed.]—*Mitt. biol. Anst.* (*Reichsanst.*), *Berl.*, 58, pp. 1–28, 1 graph, 1938.

The writer describes and analyses the various procedures in current use for the determination of the soundness or 'degeneracy' of potato tubers destined for seed. Many of the methods enumerated have been noticed here [cf. *R.A.M.*, xvi, p. 829; xvii, pp. 549, 763, *et passim*].

SINGH (B. N.) & MATHUR (P. B.). **Artificial production of 'blackheart' in Potato tubers.**—*Phytopathology*, xxviii, 10, pp. 705–708, 1938.

Experimental data are presented showing that stored Katua potato tubers are most susceptible to 'black heart' [? at Benares, India: *R.A.M.*, xvii, p. 201] during the middle dormancy period, when 20·2 per cent. of the test material developed the condition after 48 hours' exposure to a temperature of 40·3° C., whereas in the early dormancy stages a corresponding period at 48·1° was required to produce comparable effects. The figures obtained for the late dormancy phase were anomalous, probably on account of the accidental inclusion of tubers in the incipient stage of sprouting. Data obtained from potatoes in the growing season showed that very small, actively growing tubers were much more resistant to 'black heart' than mature ones, the former remaining unaffected by 105 hours' exposure to a temperature of 57·1°, whereas 0·1 per cent. of the latter showed symptoms of the disease after 70 hours at 52·7°. During a ten-day period of ripening in the soil after cessation of growth, 0·9 per cent. of the tubers were found to be diseased after 90 hours' heating at 48·1°. Some evidence was obtained that large potatoes are more susceptible to 'black heart' than small ones.

WENZL (H.). **Über die Zusammenhänge zwischen Braunmarkigkeit (Hohlherzigkeit) und Wuchsform der Kartoffelknollen.** [On the correlations between medullary browning (hollow heart) and growth form of Potato tubers.]—*Phytopath. Z.*, xi, 3, pp. 282–296, 4 figs., 3 graphs, 1938.

The examination at the Vienna Plant Protection Institute of four batches of Böhm's Allerfrüheste Gelbe potato tubers revealed a fairly reliable correlation between medullary browning or hollow heart [*R.A.M.*, xvii, p. 410] and an abnormal growth form, characterized by deep placing of the eyes and the development of cushions beneath them. These features were more conspicuous in large than in small tubers. Excessive thickness is another common symptom of hollow heart in large tubers, but length variations do not afford a safe diagnostic criterion. Although higher percentages of the disease were found among large misshapen tubers, a fair number of large individuals of approximately normal growth forms were also affected. The irregular growth

processes herein described, usually but not invariably localized below the eyes, are brought about at least partially by the withdrawal of reserve materials from the medullary region of the tubers.

BORDUKOVA (Mme M. W.). **Über die Bestimmung der Widerstandsfähigkeit der Kartoffeln gegen die Phytophthora.** [On the determination of resistance to *Phytophthora* in Potatoes.]—*Obst- u. GemüsebWirtsch.*, ix, pp. 29–32, 1937. [Russian. Abs. in *Zbl. Bakt.*, Abt. 2, xcix, 9–13, p. 285, 1938.

In inoculation experiments by the very effective contact method to determine the varietal reaction of potatoes to *Phytophthora* [*infestans*] with a view to the control of the fungus by breeding in the U.S.S.R. [*R.A.M.*, xvi, p. 553, and cf. xvii, p. 413], a close study of the course of the disease revealed the following process. In resistant varieties, such as *Solanum demissum* forms *recurvoacuminatum*, *xitlense*, and *tlaxpehualcoense*, and No. 8670, the tissues are so sensitive to infection that necrosis rapidly sets in, resulting in very unfavourable conditions for the pathogen, which is quickly killed. In susceptible varieties, on the other hand, the tissues show no initial reaction to invasion, the cells only dying after the requirements of the parasite have been exhausted, at which stage the infected region is deeply permeated by the mycelium.

VAN HAERINGEN (G. H.). **Eenige waarnemingen in de praktijk over Phytophthora erythroseptica.** [Some practical observations on *Phytophthora erythroseptica*.]—*Tijdschr. PlZiekt.*, xliv, 5, pp. 247–256, 1 graph, 1938.

Since 1926 the writer has been engaged on a study of the factors affecting pink rot of potatoes (*Phytophthora erythroseptica*) [*R.A.M.*, iii, p. 317; xv, p. 556], which is stated to be prevalent on reclaimed marsh soils in Holland, causing appreciable damage, especially in dry, warm seasons when the soil temperature rises to 20° C. and above at a depth of 10 cm., and water is withdrawn from the subsoil. Large tubers are liable to heavier infection than smaller ones. Control measures should include the cultivation of varieties retaining luxuriant foliage until late in the summer, such as Roode Star, Populair, and Eigenheimer; Eersteling [Duke of York] and Bintje are nearly always attacked. This desirable habit of growth may be promoted by liberal applications to the soil of stable manure and chlorine-free potash, correct methods of tilling, and prompt eradication of weeds. The structure of the soil should be improved in such a way as to minimize its capacity for conducting heat and evaporating water, e.g., by the incorporation of raw organic materials and green manure. Deep drainage should be practised in order to obviate the accumulation of stagnant water, and care taken to ensure the permeability of the subsoil.

DENNY (F. E.). **Combining treatments for disinfecting Potato tubers with treatments for breaking dormancy.**—*Contr. Boyce Thompson Inst.*, ix, 5, pp. 397–402, 1938.

The germination of recently harvested potato tubers, after disinfection with mercuric chloride, yellow oxide of mercury, or formaldehyde

[chiefly against *Actinomyces scabies* and *Corticium solani*: *R.A.M.*, xvii, p. 835] was expedited by treatment of the intact tubers with vapours of ethylene chlorhydrin by allowing commercial 40 per cent. solution to evaporate from pieces of cheesecloth spread over a watch-glass placed on top of the tubers in jars; it was equally feasible to treat with chlorhydrin first, and disinfect afterwards. Germination was not as a rule as rapid with tubers disinfected before or after treatment as with those treated with chlorhydrin alone, but the time required for 90 per cent. emergence of sprouts of disinfected tubers was shortened by 30 to over 100 days by the chlorhydrin treatment. Retardation of germination was noted in tubers disinfected with the mercury compounds shortly after harvesting and not treated with chlorhydrin. Tubers previously disinfected with mercuric chloride or yellow oxide of mercury developed much rotting of the seed pieces if treated by the chlorhydrin dip method, which involved cutting the tubers into pieces, placing them in Mason jars, covering them with chlorhydrin solution (50 c.c. of 40 per cent. solution per l.), pouring off immediately, and storing for 24 hours in the closed jar. Cut tubers responded well, however, to the chlorhydrin dip treatment if disinfected with formaldehyde before cutting. When any one of the three disinfectants was used before cutting, soaking the cut tubers for one hour in solutions of 1 per cent. sodium thiocyanate or 2 per cent. thiourea hastened germination by 20 to 80 days.

SOESMAN (J. G.). **Wortelschimmels en Hevea-herontginningen.** [Root fungi and *Hevea* clearings.]—*Bergcultures*, xii, 36, pp. 1239–1244, 3 figs., 1938.

Practical directions are given for the control of *Fomes lignosus* in replanted *Hevea* rubber clearings [*R.A.M.*, xvii, pp. 553, 624, and next abstracts] in the Dutch East Indies by deep digging (the fungus has been observed to extend downwards for 4 m. on the tap-roots) and by the removal of infected roots of susceptible cover crops, such as *Tephrosia vogelii, Crotalaria anagyroides,* and *Centrosema pubescens*. In order to secure an adequate stand of resistant trees it is necessary to commence with a sound planting supply considerably in excess of that ultimately required. A conservative method of pruning should be adopted and care taken to prevent infection of the rubber trees by lamtoro [*Leucaena glauca*] stumps and unhealthy coffee bushes, both of which are susceptible to *F. lignosus*.

DE FLUITER (H. J.). **Wortelschimmel en Heveaherontginningen.** [The root fungus and *Hevea* clearings.]—*Bergcultures*, xii, 37, pp. 1258–1266, 1938.

Commenting on Soesman's recommendations for the extermination of *Fomes lignosus* in *Hevea* rubber plantings in the Dutch East Indies [see preceding and next abstracts], the author agrees that when sound planting material has been used and conservative pruning adopted, intensive control measures are superfluous. However, should the fungus develop in spite of these precautions, vigorous and thorough control methods must immediately be undertaken.

s'Jacob (S. C.) & De Fluiter (H. J.). **Is er verband tusschen den toestand van de plant en de mate van virulentie van wortelschimmels?** [Is there a connexion between the condition of the plant and the degree of virulence of root fungi?]—*Bergcultures*, xii, 38, pp. 1290–1292, 1938.

The writers briefly summarize their observations on the connexion between debilitation of *Hevea* rubber and infection by *Fomes lignosus* [see preceding abstracts] and *F. noxius* [*R.A.M.*, xvii, p. 624] in the Dutch East Indies. In one rubber planting only 2 out of 108 sound trees were attacked by *F. noxius*, 6 out of 70 in poor condition, and 28 out of 34 dying or dead, the corresponding figures for another area being 2 out of 93, 4 out of 81, and 31 out of 38, respectively. The fungus had also spread to the coffee bushes interplanted among the diseased rubber trees. Sickly coffee bushes and stumped lamtoro [*Leucaena glauca*] were found to contract infection by *F. lignosus* and assist in the spread of the fungus to the neighbouring rubber trees. *Artocarpus blumei* stumps were shown to serve as reservoirs of infection by *F. noxius*, which may evidently remain dormant in the soil for years and resume activity with the advent of appropriate conditions for a parasitic existence.

Kletschetoff (A. N.). **Effect of Tau-saghyz seed treatment with the preparation 'granosan'.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xx, 2–3, pp. 195–198, 1938.

Examination of fruit and seed samples of the rubber-bearing plant tau-saghyz [*Scorzonera tau-saghyz*: *R.A.M.*, xvi, p. 406] revealed the presence of bacteria [unspecified] and numerous fungi (species of *Cladosporium*, *Alternaria*, *Fusarium*, *Epicoccum*, *Torula*, *Brachysporium*, *Penicillium*, and *Aspergillus*) on the surface of the fruit (achene), on the inner side of its coat, on the surface of seeds removed from the achenes, on the inner side of the seed coat, and occasionally within the embryo tissues. In laboratory seed-disinfection tests and field trials seed treatment with granosan (0·5 to 1 per cent. of the seed weight) markedly and consistently reduced the infection without affecting the rate of germination. Treatment of seed (1 per cent.) sown in sterilized and non-sterilized soil resulted in increases in the number of plants of 58 and 21 per cent., respectively, over the controls.

Campbell (Marie E.). **An investigation of the Mucorales in the soil.**—*Trans. roy. Soc. Edinb.*, lix, 2, pp. 411–436, 3 pl., 14 figs., 1938.

Full descriptions are given of the following organisms isolated from the soil in different parts of Scotland and grown on a medium of 2 per cent. agar, 4 per cent. malt, and 5 per cent. peptone (P_H about 6) in the dark at 17° to 19° C.: *Mucor spinosus*, *M. ramannianus*, *M. racemosus*, *M. circinelloides*, *M. fragilis*, *M. varians*, *M. microsporus*, *M. hiemalis*, *M. silvaticus*, *M. albo-ater*, *M. mucedo*, *M. saturninus*, *Zygorrhynchus moelleri*, *Z. vuillemini*, *Circinella sydowi*, *Rhizopus nigricans*, *Absidia glauca*, *A. cylindrospora*, *Dicoccum asperum*, *Chaetocladium jonesii*, *Piptocephalis cylindrospora* (parasitic on *M. albo-ater*), *Mortierella pusilla* [*R.A.M.*, xvii, p. 837], and *M. tuberosa*. Of these, only

three species were homothallic, viz., *P. cylindrospora*, *Z. moelleri*, and *Z. vuillemini*.

Zygospores were produced by *Mucor racemosus*, *M. hiemalis*, *A. cylindrospora*, *Z. vuillemini*, *Z. moelleri*, and *P. cylindrospora*. In the case of *M. hiemalis*, zygospore formation was much more profuse at 17° than at 26°, but no striking effects on sexual activity were exerted by various other factors considered. Hybrid zygospores were formed between opposite sexes of different species both of the same and of different genera. Perfect specimens were obtained between *M. varians* and the negative form of *M. hiemalis* and between *M. silvaticus* and the positive form of *M. hiemalis*, while imperfect hybridization occurred between the negative form of *A. cylindrospora* and the positive one of *R. nigricans*. Generally speaking, the positive forms of the Mucorales are more widely distributed in the soil than the negative. The positive mycelium of *M. hiemalis* was experimentally shown to be more resistant to desiccation over sulphuric acid than the negative, continuing to grow three months after the inception of the test, by which time the development of the negative forms had ceased.

Experiments on spore longevity in the different species of soil fungi under investigation are still in progress. To date, the spores of *M. spinosus*, *M. racemosus*, *M. hiemalis*, *M. mucedo*, *A. cylindrospora*, *R. nigricans*, *Z. moelleri*, *Z. vuillemini*, and *C. sydowi* have germinated after 7, 12, 11, 9, 12, 6, 9, 9, and 7 months, respectively.

No specific correlation could be traced between the distribution of the Mucorales forming the subject of this study and any particular soil type, certain species, e.g., *M. hiemalis*, *M. racemosus*, and *A. cylindrospora*, being practically ubiquitous. All soils, however, are not equally rich in the number of species of this group, heather moors and peat bogs, for instance, containing fewer than cultivated soils. Soil reaction does not affect all species equally: *Z.* spp. were isolated from soils at P_H 4·8 and 7·4, and *M. racemosus* at P_H 4·8 and 8, so that these species are evidently able to flourish throughout a wide range of hydrogen-ion concentrations. On the other hand, *M. hiemalis* and *A. cylindrospora* were found only between P_H 6·6 and 7·6 in the samples examined, suggesting relatively close dependence on soil reactions.

Varadaraja Iyengar (A. V.). **Some aspects of the control of spike disease in Sandalwood.**—*Phytopathology*, xxviii, 10, pp. 715–723, 1938.

This is a general survey of the past and present positions in the control of sandal (*Santalum album*) spike in India [*R.A.M.*, xviii, p. 55]. By far the most promising of the various methods of elimination hitherto tested is the destruction of diseased trees by the injection of sodium arsenite [ibid., xiv, p. 539], 1 gal. of which is stated to be sufficient for the treatment of an average of 150 trees. This procedure is now in use in Madras and Coorg, and several localities showing incipient infection have been freed from spike disease. A considerable improvement in the growth of sandal may be effected by the eradication of *Lantana* [*camara*: loc. cit.], which has gradually permeated even some of the dense forests of the Deccan plateau.

LUTHRA (J. C.), SATTAR (A.), & SINGH (S.). **Occurrence of stem canker disease of Sugarcane (Cytospora sacchari Butl.) in the Punjab.**—*Proc. Indian Acad. Sci.*, Sect. B, viii, 3, pp. 188–191, 1938.

Cytospora sacchari [*R.A.M.*, xvii, p. 840], first observed in the Punjab at Lyallpur in March, 1935, on dried pieces of several Coimbatore varieties lying about in the fields, was found in the same year as a saprophyte on Co. 244 and on Desi Ponda (thick chewing cane) in Lahore District. In the summer of 1936 it developed, apparently as a distinct parasite, on the standing crop at Lyallpur, almost all the infected canes wilting. It was also reported from three other localities.

Affected canes show drying up of the leaves from the tip downwards, wilting being the most severe form of the disease. The pycnidia are generally formed only when the cane is completely desiccated and they may develop on all parts of the cane that are above the ground. The fungus also becomes increasingly virulent when the cane reaches maturity. If it is present in the field, either as a parasite or a saprophyte, canes reserved for seed purposes and buried in the ground to protect them from frost are attacked and killed.

Isolations of the fungus from Co. 312, 313, 323, 371, and 395 sugar canes from Lyallpur and Co. 223 and 285 from Mozaffargarh and Jhang, respectively, were in all cases identical. Healthy canes of nine Coimbatore varieties were inoculated with a pure culture of the fungus by boring holes in the stem, inserting the culture and plugging the hole, each variety later showing 100 per cent. infection as against no infection in the controls (bored and replugged with no insertion of the culture). The fungus spread above and below the inoculation site to a distance of two or three internodes. No inoculated cane wilted, but disease symptoms appeared 10 to 15 days after inoculation, and pycnidia in 17 days.

BLUMER (S.). **Pilze.** [Fungi.]—*Ber. schweiz. bot. Ges.*, xlviii, pp. 239–252, 1938.

The following are among the new records in this annotated list of recently discovered or otherwise remarkable representatives of the Swiss fungus flora: *Bremia lactucae* on *Centaurea imperialis*, *Gaillardia grandiflora*, and *Senecio elegans*; *Pseudoperonospora humuli* on wild hops, whether indigenous or introduced is not known, in a remote mountain valley of Glarus; and *Tuburcinia* [*Urocystis*] *gladioli* on *Gladiolus* sp. [*R.A.M.*, xvi, p. 63].

MOESZ (G.). **Fungi Hungariae. II. Archimycetes et Phycomycetes.** [Fungi of Hungary. II. Archimycetes and Phycomycetes.]—*Ann. hist.-nat. Mus. hung.*, xxxi, pp. 58–109, 1938. [Hungarian and German.]

Continuing his studies on Hungarian fungi, part I of which (Myxomycetes) appeared in *Folia cryptog.*, Szeged, i, 3, 1925–6, the writer presents a critically annotated list, supplemented by a four-page bibliography, of 33 Archimycetes and 258 Phycomycetes, including the following. *Olpidium brassicae* has been found attacking tobacco seedlings [*R.A.M.*, vii, p. 202]. It is of interest to note that potato wart (*Synchy-*

trium endobioticum) has disappeared even from the one locality (now belonging to Czechoslovakia) where it was detected by Schilberszky in 1896 (*Ber. dtsch. bot. Ges.*, xiv, p. 36), and is no longer to be found in Hungary [cf. *R.A.M.*, xiii, p. 799], so that the theory of its spread throughout Europe from this single focus is quite untenable. *Plasmodiophora solani*, claimed by v. Brehmer and Bärner to be implicated in the transmission of potato viruses [ibid., ix, p. 800], occurs on potatoes. Opium poppies (*Papaver somniferum*) are attacked by *Peronospora arborescens* [ibid., xvi, p. 563]. *Sclerospora graminicola* [ibid., xvii, p. 160] infects *Agrostis alba* in addition to *Setaria viridis* and *S. italica*. *Pythium hydnosporum* [*P. artotrogus*: ibid., vi, p. 360] has been detected in association with *Phomopsis vexans* [ibid., v, p. 466] and *Phytophthora infestans* on tomato [ibid., xvii, pp. 224, 364, 483].

Among entomogenous fungi may be mentioned *Empusa grylli* [ibid., xv, p. 705] on grasshoppers, *E. muscae* [ibid., xvi, p. 673] on flies, *Entomophthora aphidis* [ibid., xiii, p. 683] on lucerne aphids (*Amphorophora onobrychis*), and *E. sphaerosperma* [ibid., xiv, p. 33; xv, p. 18] on larvae of *Papilio podalirius*.

Raabe (A.). **Parasitische Pilze der Umgebung von Tübingen. Ein Beitrag zur Kryptogamenflora Südwestdeutschlands.** [Parasitic fungi of the environs of Tübingen. A contribution to the cryptogamic flora of south-west Germany.]—*Hedwigia*, lxxviii, 1–2, pp. 1–106, 5 figs., 1938.

This is a critically annotated list of about 430 parasitic fungi collected by the author in the Tübingen district of Germany from 1930 to 1932 and again during 1935–6. *Botrytis globosa* n.sp. [with a Latin diagnosis], responsible for pale, water-soaked spots on garlic leaves, frequently covering half the surface, is characterized by straight, pluricellular, simple or sparsely branched conidiophores, 0·3 to 0·8 by 12·5 to 15 μ, globular (14 to 18 μ in diameter) or slightly elliptical (14 to 21 by 12 to 20 μ) conidia, and small, greenish-brown sclerotia resembling in their dense, microcellular texture those of *Botrytis cinerea*. *Mycosphaerella hordei* forms greyish-brown, dry lesions on wheat leaves.

Elisei (F. G.). **Revisione del genere Titaeosporina van Luijk (Deuteromycetes-Melanconiales).** [A revision of the genus *Titaeosporina* van Luijk (Deuteromycetes-Melanconiales).]—*Atti Ist. bot. Univ. Pavia*, Ser. IVa, x, pp. 283–287, 1938.

After referring to the establishment by van Luijk of the genus *Titaeosporina* with the type species *T. tremulae* (*Ann. mycol., Berl.*, xvii, pp. 110–113, 1919), based on the presence in herbarium material of *Gloeosporium populi-albae* and *G. tremulae* of conidia united into groups of two or more by connecting hyphae, the author points out that the occasional presence of these joined conidia is insufficient to establish more than a new variety, at most. From van Luijk's figures the acervulus, conidiophores, and conidia when young all belong to *Gloeosporium* and the joined conidia may have been merely united by anastomoses. A similar occurrence has been reported for *Ascochyta viciae* by Crosier (*Phytopathology*, xxv, 2, pp. 283–284, 1935).

HIRATSUKA (N.). **Notes on Japanese species of Uromyces.**—*J. Jap. Bot.*, xiii, 10, pp. 729–747, 1937.

Among the 73 species in this annotated list of Japanese *Uromyces* may be mentioned *U. decoratus* on *Crotalaria juncea* and *U. holwayi* on *Lilium auratum* [*R.A.M.*, x, p. 667].

KERN (F. D.). **Additions to the Uredinales of Venezuela.**—*Mycologia*, xxx, 5, pp. 537–552, 1938.

This annotated list of Venezuelan Uredinales adds 22 species from various sources to the previous lists [cf. *R.A.M.*, xiv, p. 397], bringing the total up to 205. *Puccinia arachidis* on groundnut [ibid., xiv, p. 212], *Uromyces fabae* on *Vicia faba*, and *U. striatus* on lucerne [ibid., xvi, p. 776] are recorded for the first time from Venezuela and *P. polyspora* on Guatemala grass (*Tripsacum laxum*) for the first time from South America.

MIX (A. J.). **Species of Taphrina on North American Ferns.**—*Mycologia*, xxx, 5, pp. 563–579, 3 figs., 1938.

This is an annotated, descriptive list, based on examination of material in the larger mycological herbaria of the United States and Canada, of ten species of *Taphrina* on North American ferns, arranged under their respective hosts. Five of the species are published as new [with Latin diagnoses].

WILTSHIRE (S. P.). **The original and modern conceptions of Stemphylium.**—*Trans. Brit. mycol. Soc.*, xxi, 3–4, pp. 211–239, 2 pl., 17 figs., 1938.

From the original diagnosis and from an examination of Wallroth's specimen of *Stemphylium botryosum* (1833) [*R.A.M.*, xvi, p. 575] the writer concludes that this species is identical with that known in the literature as *Macrosporium sarcinula* (1838), the conidial stage of *Pleospora herbarum*. Fungi with conidia of this type have been placed in the genus *Thyrospora* [ibid., v, p. 233], which is therefore synonymous with *Stemphylium*, and *T. parasitica* and various other species of *Macrosporium* are regarded as synonymous with *S. botryosum*. The modern conception of *Stemphylium* is traced to *S. lanuginosum* of Harz, with which Oudemans's culture of *S. botryosum* studied by Bolle [ibid., iv, p. 62] is considered to be probably identical. The author proposes to enlarge the original conception of *Stemphylium* to include the species similar to *S. lanuginosum*, placing the former groups in *Eustemphylium* and the latter in *Pseudostemphylium*. *T. sarcinaeforme*, found on clover in Hampshire in 1932 [cf. ibid., xiv, p. 396], is renamed *S. sarcinaeforme* (Cav.) n.comb., *M. sophorae* Turc. & Maff. 1912 being regarded as a synonym. *S. macrosporoideum* and *S. asperosporum* are deemed to be foreign to *Stemphylium*, and for want of a better genus are renamed, respectively, *Acrospeira macrosporoidea* (Berk.) n.comb. and *A. asperospora* (Cooke & Massee) n.comb.; a fungus of similar type received from Baarn is named *A. levis* n.sp. [with a Latin diagnosis]. In conclusion, *S. quadratum* is transferred to *Tetracoccosporium* as *T. quadratum* (Cooke) n.comb.

Wallace (J. M.). **Acquired tolerance of curly top in Nicotiana tabacum.**—Abs. in *Phytopathology*, xxviii, 9, p. 674, 1938.

Tobacco plants are stated frequently to recover from [beet] curly top [cf. *R.A.M.*, xviii, p. 64], even those with severe symptoms on the terminal leaves often producing basal or lateral shoots virtually or entirely free from outward signs of infection. In other cases recovery may come about gradually by the production of mildly affected leaves and tissues in terminal shoots that have long shown conspicuous symptoms and retarded growth. Cuttings grown from recovered plants possess an acquired tolerance to curly top when tested by reinoculation, whereas those from healthy, uninoculated plants readily contract infection in an intense form. Tolerance also developed following infection with one strain of the virus after previous inoculation with another.

Guba (E. F.). **Tomato leaf mold as influenced by environment.**—*Bull. Mass. agric. Exp. Sta.* 350, 24 pp., 7 graphs, 1938.

Studies conducted over a period of several years showed that tomato leaf mould (*Cladosporium fulvum*) [*R.A.M.*, xvii, p. 634] is generally epidemic in greenhouses in Massachusetts from June to October, when the maximum temperatures in the houses range from 80° to 92° F., the mean minimum inside and outside temperatures differ by less than 5°, and the mean maximum relative humidity is 94 to 100 per cent. (the highest for the year). It was also found in outdoor plantings adjacent to greenhouses in which tomatoes were growing, and in places where the ground was uneven and the drainage poor.

The spores of *C. fulvum* are able to withstand severe winters, and remain viable under even the most adverse conditions for 9 to 12 months. Optimum conditions for germination consist in a relative humidity of 100 per cent., or precipitated moisture and temperatures of 75° to 78°. The minimum relative humidity at which germination occurred was 95 to 96 per cent., while the maximum and minimum temperatures were 94° and 40°, respectively. Viability was lost by exposure to 115° to 116° for 2 hours, and by longer exposures at somewhat lower temperatures. Exposure of infected plants for three hours to temperatures of 118° to 123° did not appreciably affect spore germination, but was injurious to the plants. Light retarded spore growth and suppressed germination, while strong light was lethal to the spores.

Infection is effected through the stomata, and took place generally or wholly on the lower surface of the leaf, where the stomata are most numerous, and where conditions in the leaf as well as those of light, temperature, and relative humidity at the surface are more favourable to germination than is the case on the upper surface. Flaccidity of the foliage, induced by moisture deficiency in the leaves, and darkness close the stomata and hinder infection.

The conditions existing at the leaf surface are of fundamental importance in the infection process, variations in severity in the greenhouse at different times of the year being due to environmental factors inducing or preventing germination on the leaf. Severity of infection is fundamentally related to temperature.

BAWDEN (F. C.) & PIRIE (N. W.). **Crystalline preparations of Tomato bushy stunt virus.**—*Brit. J. exp. Path.*, xix, pp. 251–263, 1 fig., 1 graph, 1938.

The following points may be noticed in this amplified account of the authors' study on the properties of the crystalline preparations of tomato bushy stunt virus [*R.A.M.*, xvii, p. 566]. The serological titres of the purified bushy stunt virus were found to be consistently lower than those of the liquid crystalline tobacco mosaic virus and potato virus X, a difference probably due to the different shapes of the virus, the particles of the bushy stunt virus apparently being spherical. Precipitates of tobacco mosaic virus and virus X with their antisera are flocculent, and after settling occupy a large volume, thus closely resembling those obtained with bacterial flagellar ('H') antigens, whereas precipitates of the bushy stunt virus with its antiserum form more slowly, are granular, settle as compact masses, and are of the type obtained with bacterial somatic ('O') antigens. The bushy stunt virus is shown to be inactivated by warm acetic acid and by wetting and spreading agents, such as sodium dodecyl sulphate. The amount of nucleic acid isolated from the supernatant fluids present when virus preparations inactivated by the above-mentioned agents are precipitated is from 15 to 20 per cent. of the weight of virus taken. The ash content of virus preparations recrystallized several times with ammonium sulphate and dialysed for many days against distilled water at P_H values from 3 to 5 did not usually fall below 3 per cent. Although the bushy stunt virus is very sensitive to dehydration, it did not precipitate and underwent no apparent change when exposed for some hours at room temperature to P_H values of between 1·5 and 9·5. At P_H 1 the virus solutions rapidly became water-clear and on neutralization the protein was precipitated and the virus inactivated. Exposure to P_H 10 for a few hours destroyed infectivity. The virus can be inactivated by ultra-violet light, nitrous acid, formaldehyde, or hydrogen peroxide without losing its crystallinity or serological activity.

MCFARLANE (A. S.) & KEKWICK (R. A.). **Physical properties of bushy stunt virus protein.**—*Bio-chem. J.*, xxxii, 9, pp. 1607–1613, 1 fig., 1 diag., 2 graphs, 1938.

A detailed account is given of the writers' studies at the Lister Institute, London, on the physical properties of specially prepared specimens of Bawden and Pirie's tomato bushy stunt virus protein [see preceding abstract], consisting of colourless solutions, water-clear by transmitted light.

The mean partial specific volume of 0·739 is approximately the same as Bawden and Pirie's value for tobacco mosaic and falls within the density range of the proteins as a class. The mean value of the sedimentation constant is determined as 146×10^{-13}, i.e. lower than for the tobacco mosaic and cucumber virus proteins but higher than those of potato virus X and tobacco ring spot [ibid., xvii, pp. 207, 647, *et passim*]. The boundary is that of a perfectly homogeneous protein and shows a degree of sharpness hitherto obtained only with some of the heavier haemocyanins. The P_H stability range is a comparatively wide

one (2·40 to 8·70). There were no signs within this range of a minimum solubility zone with molecular aggregation such as characterizes some of the anisotropic virus proteins. The sedimentation equilibrium was found to be complete after 96 hours. The mean molecular weight value of the protein, determined by two alternative formulae, Svedberg's and Pedersen's, is 7,600,000. Calculated by sedimentation velocity measurements (Stokes's law), the weight of the molecule is 8,800,000 and its radius 13·7 mμ, indicating little or no tendency towards asymmetry. The minimum electrophoretic mobility was registered at P_H 4·12 (0·15 cm. $2V.^{-1}$ $sec.^{-1} \times 10^{-5}$) and the maximum (4·59) at P_H 5·47. The isoelectric point of the virus protein was found to be $P_H = 4·11$.

MOUNCE (IRENE) & MACRAE (RUTH). **Interfertility phenomena in Fomes pinicola.**—*Canad. J. Res.*, Sect. C., xvi, 9, pp. 354–376, 1 map, 1938.

In further studies on the biology of *Fomes pinicola* [*R.A.M.*, viii, p. 690; xviii, p. 4], cultures from 43 new sources originating on various coniferous and deciduous hosts in various localities of Canada, the United States, France, Sweden, Germany, and Japan, served to pair all possible combinations of a number of monosporous mycelia. As a result it became evident that the isolates from North America may be divided into a large group, A (containing isolates from *Abies*, *Picea*, *Pinus*, *Pseudotsuga*, *Tsuga*, *Betula*, *Populus*, and *Prunus*), and a small one, B (from *Picea*, *Tsuga*, and *Populus*). Clamp-connexions were formed in every pairing of one member of either of the two groups with any other member of the same group, but not crosswise. Thus each of the two groups is interfertile within itself but not cross-fertile with the members of the other group. Isolates from Europe and Japan form a third group, C (from *Picea*, *Pinus*, *Betula*, and *Salix*), which is completely interfertile within itself, almost completely fertile with members of group A, and only partially sterile with some of the members of group B. The three cultures isolated from *Populus* included in group B were obtained from sporophores typical of the form common on that host, sometimes regarded as a separate species, *F. marginatus*. The remainder of the isolates in group B were, however, the typical 'red belt' form commonly found on coniferous hosts.

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xii, 10, pp. 219 M–220 M, 1938.

COLOMBIA. In pursuance of Decree No. 742 of 27th April, 1938, the banana-growing region of the Department of Magdalena is declared a quarantined zone owing to heavy infection by *Cercospora musae* [see above, p. 124]. As an immediate preventive measure against the further spread of the disease, growers were instructed to strip off all infected leaves from the plants and destroy them by burning or burying at a depth of not less than 60 cm. within 15 days of the date of promulgation of the above-mentioned Decree.

Decree No. 762 of 29th April, 1938, places the campaign against sugar-cane mosaic [*R.A.M.*, xviii, p. 56] in the hands of a technical Commission, whose work will be assisted by a Central Sugar-Cane Experiment Station.

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HARTLEY (C.). **A decade of research in forest pathology.**—*J. For.*, xxxvi, 9, pp. 908–912, 1938.

This is a survey of some outstanding researches in the field of silvicultural pathology during the past ten years in the United States.

LIUBARSKY (V. L.). Дереворазрушающие грибы Березы Шмидта. **(Betula schmidtii Rgl)** [Wood-destroying fungi of the Schmidt Birch (*Betula schmidtii* Rgl).]—*Bull. Far Eastern Br. Acad. Sci. U.S.S.R.* 29 (2), pp. 113–118, 1938.

The author records 39 fungi attacking *Betula schmidtii*, growing in the basin of the Mongougai river in the Far Eastern region of the U.S.S.R. mainly in association with oak. The chief parasite, causing most serious damage, was *Polyporus sulphureus* [*R.A.M.*, xviii, p. 4].

CAMPBELL (W. A.) & DAVIDSON (R. W.). **A Poria as the fruiting stage of the fungus causing the sterile conks on Birch.**—*Mycologia*, xxx, 5, pp. 553–560, 3 figs., 1938.

In August, 1937, a brown *Poria* was collected on a limb of a decayed, standing yellow birch (*Betula lutea*) in the October Mountains State Forest, Massachusetts, and extensive search in the area showed it to be commonly present on dead, standing, decayed yellow and white birch (*B. populifolia*) trunks, but only on those bearing sterile conks. Sporophore and spore isolations from the *Poria* yielded a fungus identical with that obtained from the conks and the decay associated with them, demonstrating that the *Poria* was the fruiting stage of the fungus causing the conks [cf. *R.A.M.*, viii, p. 345].

Infection appears to take place through trunk and top wounds, branch stubs, and old, open *Nectria* cankers. The *Poria* produces a well-defined heart rot which spreads up and down the trunk, but is prevented by the sapwood from any extensive radial spread. In time, a sterile conk, consisting of brown, short-celled, parallel hyphae, which appear as pseudoparenchyma cells in cross-section, develops, presumably at the point of entry, and frequently at other places on the trunk where the *Poria* penetrates the sapwood. The conks appear to enlarge year by year, sometimes attaining a diameter of over 1 ft. At first they are yellowish-brown, but soon turn into a dark, cracked, clinker-like mass. The tree weakens and often breaks, usually where a conk has formed. After the death of the tree the conk ceases to enlarge.

The fungus in the trunk grows out through the dead sapwood, and in two or three years forms a thin, dark brown layer of the same type of hyphal cells as are found in the sterile conk; this layer develops into the brown *Poria*. By the time the fungus has split the bark and is able to shed spores, the decay is well advanced and the conks are often so badly weathered as to be almost unrecognizable. Insects attack the sporophore as soon as it breaks through the bark and rapidly cause it to disintegrate. Fruiting appears to take place chiefly in the early summer, but may last until October.

The fungus would seem to belong to the *P. obliqua* complex and to be probably identical with the fungus resembling *P. obliqua* on birches in Sweden and the U.S.S.R. Unlike Skoric's fungus, however, found on oak in Europe [ibid., xvi, p. 506], it fruits under the bark and thin wood layer of dead trees, does not possess readily demonstrable setal hyphae in the trama, and in culture forms setal hyphae seldom exceeding 8 μ in diameter.

Pomerleau (R.). **Recherches sur le Gnomonia ulmea (Schw.) Thüm.** [Studies on *Gnomonia ulmea* (Schw.) Thüm.]—*Nat. canad.*, lxiv, 11, pp. 261–289; 12, pp. 297–318, 1937; lxv, 1, pp. 23–41; 2, pp. 57–70; 3, pp. 89–97; 4, pp. 125–137; 5, pp. 167–188; 8–9, pp. 221–237; 10, pp. 253–279, 22 pl., 1 fig., 2 diags., 8 graphs, 1938.

The author has made an exhaustive study of the life-history of *Gnomonia ulmea* on elms [*R.A.M.*, xviii, p. 11] in Quebec, and presents a fully documented and tabulated account of his researches, dealing primarily with the bio-ecological and histo-cytological aspects of the subject.

The distribution of the fungus in Canada and the United States is co-extensive with that of its principal host, *Ulmus americana*; it is also occasionally observed on *U. fulva* and *U. racemosa*, while according to L. E. Miles (*Bot. Gaz.*, lxxi, p. 161, 1921), it may further be found on *U. alata*, *U. crassifolia*, and possibly *U. serotina*. *G. ulmea* is a strictly obligatory parasite, developing exclusively on the tender, living tissues of its hosts. Its life-cycle terminates in the autumn, shortly after the death and fall of the leaves, with the formation of ascospores, which attain maturity under local conditions at the beginning of December. Next spring (May) ascospores are ejected for a distance of 3 to 4 mm. from the perithecia on the dead foliage under a particular combination of weather conditions comprising a temperature of at least 45° F. for several days and an alternation of wet and dry periods. The discharge of the ascospores generally synchronizes almost exactly with the inception of new growth on the host, which is readily invaded. The ascospores germinate immediately in a saturated atmosphere; they are enveloped by a brownish secretion which presumably assists in the penetration of the cuticle, no appressoria having been detected. The mycelium may invade the entire mesophyll. In young leaves the resultant lesions may reach a considerable size, but they are usually limited in adult foliage. The mycelium is intercellular and forms a black subcuticular stroma, constituting the base of the acervulus. The conidia are detached and disseminated, after the rupture of the cuticle, exclusively under the action of rain; they serve to perpetuate the disease

throughout the summer at an intensity varying with weather conditions, especially humidity, an abundance of which is essential for each fresh crop of foliar infections. In the districts under observation the formation of the sexual phase of *G. ulmea* does not begin until the end of June. The cytological processes of the elm pathogen are fully described and discussed.

With regard to control, the author states that in a local planting of young elms (under six years) satisfactory results have been secured with two applications of 4–4–40 Bordeaux mixture, one before the leaves are fully expanded and the other towards the end of July.

SWINGLE (R. U.). **A phloem necrosis of Elm.**—*Phytopathology*, xxviii, 10, pp. 757–759, 1938.

A virulent phloem necrosis of American elms [*Ulmus americana*], first observed in Ohio in 1918, was responsible at Chillicothe during 1936–7 for the death of a thousand trees, or half the city's elms. The first symptoms, which ultimately involve the whole crown, appear at the outer tips of the topmost branches, where the foliage becomes thin, the leaves droop because of the downward curvature of the petioles, and the leaf blades turn up at the margin, producing a trough-like effect, often accompanied by stiffness and brittleness. Subsequently the leaves turn yellow and fall. At a more advanced stage of infection the root phloem and cambium become discoloured prior to death, and frequently the discoloration extends into the trunk and branches. The cambium first turns light yellow or golden and the adjacent phloem yellow, later brown, with small, scattered, black flecks, and finally dark brown and necrotic. Moderately discoloured phloem emits a characteristic odour of wintergreen. No organism has been consistently isolated from the infected tissues or observed in association with them, and the only means of transmitting the disorder from affected to healthy trees was by grafting patches of diseased bark, root scions, or branch scions from the former on to the latter, which led to the complete transference of symptoms in 14 out of 21, 5 out of 26, and 13 out of 20 cases, respectively. The phloem necrosis would appear to be of a systemic character and due to a virus.

DAVIDSON (R. W.) & LORENZ (R. C.). **Species of Eutypella and Schizoxylon associated with cankers of Maple.**—*Phytopathology*, xxviii, 10, pp. 733–745, 5 figs., 1938.

Latin and English diagnoses are given of *Eutypella* (*Eutypa*) *parasitica* n.sp. and *Schizoxylon microsporum* n.sp., found producing cankers on sugar and red maples (*Acer saccharum* and *A. rubrum*) in the Lake States in 1935.

The *Eutypella* cankers are characterized by firmly attached bark, with underlying marginal, heavy, white to buff mycelial fans, slightly raised concentric rings of callus, and long-beaked, black, subglobose perithecia, 0·6 to 0·9 mm. in diameter, with black, sulcate ostioles, irregularly crowded together in groups of 10 to 40 or more in the centres of old overgrowths. The average annual extension of the cankers, about ½ in., is occasionally interrupted, imparting an irregular appearance to the excrescences and leading to considerable stem distortion

in older trees. The fungus penetrates deeply into the sapwood below the canker and also grows slowly upwards and downwards, forming a central column of discoloured wood. Infection appears to occur when the trees are young and may continue for many years. The cankers are usually formed at a height of 2 to 8 ft. from the ground, but have occasionally been observed both at soil-level and 30 ft. above it. Usually there is only one on a tree. The fungus often kills young trees but seems at present to be of importance only in stands containing a high proportion of sugar maple. Inoculation experiments carried out in 1936 failed to yield conclusive evidence of parasitism. *E. parasitica* is further characterized by stipitate asci, the spore-bearing portion measuring 32 to 40 by 6 to 7 μ and the stipe 10 to 40 by 1·5 μ, containing eight irregularly bi- or pluriseriate, slightly curved, dark brown ascospores, 8 to 11 by 2 to 2·3 μ, and curved, hyaline to pale buff, cylindrical conidia, tapering at both ends, 26 to 34 by 1 μ (found in culture only). Good growth was made at 20° to 35° C., little or none at 40°.

The damage caused by *S. microsporum* appears to be insignificant, the cankers being rare and usually occurring on suppressed trees less than 3 in. in diameter. The cankers are smaller and more sunken than those of the *Eutypella* type and the marginal, white mycelial fans are relatively inconspicuous. The irregular extension of the overgrowths is accompanied by distortion of the trunks, at first manifested by a flattening and later by a protruding margin of thickened callus tissue. The pale grey, globose pycnidia of *S. microsporum*, 0·6 to 1 mm. in diameter, are commonly to be found imbedded in the exposed wood or in the bark near the margin of the canker, occasionally accompanied by flask- or cup-shaped apothecia, 0·7 to 1 mm. in diameter. The cylindrical, short-stalked asci measure 170 to 200 by 8 to 12 μ, the filiform, simple, pluriseptate paraphyses 1·3 to 1·7 μ in diameter, and the filiform, pluriseptate ascospores 1 μ or less in diameter, subsequently breaking up into short rods or slightly curved segments, usually 2 to 3 by 1 μ, sometimes 4 to 8 by 1 μ. *S. microsporum* grew well on 2·5 per cent. malt agar at 15° to 30°.

FOWLER (M. E.). **Twig cankers of Asiatic Chestnuts in the eastern United States.**—*Phytopathology*, xxviii, 10, pp. 693–704, 1 fig., 1938.

Of the various fungi isolated from dying Chinese and Japanese chestnuts (*Castanea mollissima* and *C. crenata*) on poor sites in different parts of the eastern United States, three, namely, *Cryptodiaporthe castanea* [*R.A.M.*, xvi, p. 845], *Botryosphaeria ribis* [var.] *chromogena* [ibid., xvii, p. 755], and *Diplodia* sp. [ibid., xvii, p. 355] were shown by inoculation experiments to be capable of invading the living tissue and producing twig cankers and die-backs. *D.* sp. is characterized by black, globoid, erumpent pycnidia, usually produced in groups in a stroma in the outer cortical layer. The ovoid to elliptical conidia, 18 to 26 by 11·5 to 16 μ, are subhyaline and non-septate at first, frequently becoming dark and uniseptate at maturity.

C. castanea, the fungus most commonly associated with chestnut cankers, has been found in 18 States and the District of Columbia, and is thought to have been present for some time in 30- to 40-year-old groves, though possibly of European origin. It may cause damage in

nurseries and among planted trees, frequently killing individual branches and thus decreasing growth and inducing deformation. The other two organisms under observation have only been collected a few times and are not yet known to be of much importance.

SMITH (C. O.). **Inoculation on conifers with the Cypress Coryneum.**—*Phytopathology*, xxviii, 10, pp. 760–762, 1938.

A planting of *Cupressus macrocarpa* at the Citrus Experiment Station, Riverside, California, is stated to have been reduced by *Coryneum cardinale* [*R.A.M.*, xvii, p. 715] to a few trees, which are now severely infected, while adjacent stands of *Cupressus sempervirens* and *C. glauca* have apparently escaped. Positive results were given by inoculation experiments involving the insertion of mycelium from pure cultures of the fungus or disks from spore-bearing lesions through wounds on *C. arizonica*, *C. bakeri*, *C. duttoni*, *C. forbesi*, *C. glabra*, *C. goveniana*, *C. guadalupensis*, *C. lusitanica*, *C. macnabiana*, *C. macrocarpa*, *C. pygmaea*, *C. sargenti*, *C. sempervirens*, *C. thurifera*, *Thuja plicata*, *T. orientalis*, *T. occidentalis*, *Juniperus cedrus*, *J. californica*, *J. virginiana*, and *Libocedrus decurrens*. Some of the *Cupressus* stems were partially or entirely girdled by the cankers after 3½ months, while on the other trees used in the tests the spread of the fungus was less rapid.

PIERSON (R. K.) & BUCHANAN (T. S.). **Age of susceptibility of Ribes petiolare leaves to infection by aeciospores and urediospores of Cronartium ribicola.**—*Phytopathology*, xxviii, 10, pp. 709–715, 1938.

A tabulated account is given of experiments in which *Ribes petiolare* leaves of 18 age classes from 1 to 72 days were inoculated with aqueous suspensions of the aecidiospores and uredospores of *Cronartium ribicola* [*R.A.M.*, xviii, p. 72]. Infection occurred at all ages, but was most severe in the case of both spore types on young foliage (up to three weeks after emergence from the buds) and gradually decreased after the leaves reached their mature size.

ZOGG (H.). **Bispora nigra, ein neuer holzverfärbender Pilz.** [*Bispora nigra*, a new wood-staining fungus.]—*Ber. schweiz. bot. Ges.*, xlviii, pp. 5–8, 1 fig., 2 graphs, 1938.

Latin and German diagnoses are given of *Bispora nigra* n.sp., a saprophyte isolated in pure culture on malt agar from a partially decayed and blue-stained spruce (*Picea excelsa*) [*P. abies*] telegraph pole in the canton of Berne in 1937. The fungus, which made profuse growth at a temperature of 23° to 24° C., with a minimum above 3°, is characterized by intensely black, smooth, semi-lustrous, spreading colonies, consisting of fuliginous, septate, branched, repent hyphae, 2 μ in diameter; the hyaline, later opaquely granular conidia, 10·5 to 20 by 6·5 to 10 μ, are non- to bi-, generally uniseptate and arise either in branched chains, as a result of the disintegration of the hyphae, or singly from short lateral branches. The shape of the concatenate conidia varies according to their position in the chain, those at the ends being ovoid to globular while the middle ones are commonly fusiform and truncated at both ends.

Hunt (G. M.). **Treating wood for protection and service.**—*J. For.*, xxxvi, 9, pp. 885–888, 1938.

This is a general review of the progress made during the last ten years in the development of wood preservatives (against insect and fungal decay and fire) in the United States.

Hadert (H.). **Uebersicht über die bekanntesten Holzschutzmittel.** [Survey of the best-known wood preservatives.]—*Farben-Chem.*, ix, 9, pp. 296–300, 1938.

This is a useful summary, incorporating the latest available information, of up-to-date methods of timber preservation and their practical applications in modern life in Germany and elsewhere.

Lackey (C. F.). **Curly-top virus in root tips of Sugar Beets and Beans.**—Abs. in *Phytopathology*, xxviii, 9, p. 671, 1938.

The translocation of the curly top virus has been found to take place through the phloem of its hosts, while studies on the root tips of sugar beets [see next abstract] and beans [*Phaseolus vulgaris*: *R.A.M.*, xvii, p. 646] further revealed the presence of the virus below the protophloem sieve-tubes in the meristematic region. Tests for the virus in sections of fresh root tips from 0·2 to 0·5 mm. in length disclosed a much higher percentage of infection in the tissues below the protophloem sieve-tubes of susceptible beets than in sections including this region or in entire rootlets 5 mm. long. When four sections were cut from tips, each 0·5 mm. in length, twice as much infection was produced with virus from the third as from the second section but less than from that of the root cap. Similar results were obtained from diseased bean root tips, although there was less difference between the percentages of infection in the three lots of tissue. Degeneration of the pericycle of the root tips closely follows the sieve-tubes. Isolated cases of cellular degeneration have been observed in the meristematic region immediately below the extreme end of the sieve-tubes, but as a rule there is no perceptible evidence of the virus in this part of the root tips.

Carsner (E.). **The present status of curly-top resistance in Sugar Beets.**—Abs. in *Phytopathology*, xxviii, 9, p. 669, 1938.

Under exposure to intensive infection by curly top [*R.A.M.*, xviii, p. 78 and preceding abstract], the U.S. 12 sugar beet variety [*R.A.M.*, xvii, p. 718] yielded 1·7 tons available sugar per acre as compared with a total root production of 1·6 tons from the European variety R[abbethge] & G[iesecke] Old Type. In a less severely exposed site U.S. 12 yielded 23·7 tons of beets and 3·2 of available sugar per acre compared with 10 tons of beets for R. & G. The U.S. 33 and 14 varieties are characterized by moderate resistance to curly top and high sugar content, but the adaptability of the latter variety is restricted by its susceptibility to downy mildew [*Peronospora schachtii*].

Osborn (H. T.). **Incubation period of Pea virus 1 in the aphid Macrosiphum solanifolii.**—*Phytopathology*, xxviii, 10, pp. 749–754, 1938.

The exposure of successive series of healthy broad bean (*Vicia faba*) plants to colonies of the potato aphid (*Macrosiphum solanifolii*) allowed

to feed for short periods on the same host infected by pea virus 1 [enation mosaic: *R.A.M.*, xiv, p. 486; xvii, pp. 505, 575] showed the minimum and maximum times of incubation of the virus in the insect to be 12 and 18 hours, respectively. Aphids that had acquired the virus were found to retain it for as long as 21 days when fed continuously on non-susceptible tomato plants. Experiments on the transmission of the virus by the bean aphid (*Aphis rumicis*) gave negative results.

ARK (P. A.) & BARRETT (J. T.). **Phytophthora rot of Asparagus in California.**—*Phytopathology*, xxviii, 10, pp. 754–756, 1 fig., 1938.

A species of *Phytophthora* was responsible in March, 1938, for a soft, water-soaked, malodorous rot of Californian asparagus grown for the New York and Chicago markets (6 to 18·5 per cent. infection in a sample of field material examined and 20 to 30 per cent. in one from a packing-house). The fungus was killed by 15 minutes' immersion in 2 per cent. Labarraques solution (2·6 per cent. sodium hypochlorite), 10 minutes in 0·25 per cent. commercial ammonium hydroxide (28 per cent. strength), 5 minutes, ½ minute, and 5 minutes, respectively, in 0·25, 0·5, and 0·05 per cent. sodium peroxide, and 1 minute in water at 46° C., and none of these treatments caused any injury to the asparagus. Experimental treatments of asparagus with field infections gave a considerable degree of control. The disease was apparently promoted by persistent heavy rainfall and possibly also by the common practice of flooding certain areas to stimulate early growth.

JAGGER (I. C.), WHITAKER (T. W.), & PORTER (D. R.). **Inheritance in Cucumis melo of resistance to powdery mildew (Erysiphe cichoracearum).]**—Abs. in *Phytopathology*, xxviii, 9, p. 671, 1938.

Resistance to powdery mildew (*Erysiphe cichoracearum*) in the No. 45 cantaloupe, a cross between the very susceptible Hales Best and a highly resistant plant of an undetermined Indian variety and now the leading variety in the Imperial Valley, California [*R.A.M.*, xviii, p. 85], appears to be inherited as a simple Mendelian dominant factor. All the F_1 progeny of crosses between homozygous resistant and homozygous susceptible plants showed the same high degree of resistance as the resistant parent, while in the F_2, 233 resistant and 86 susceptible individuals were counted, approximating to the anticipated 3 : 1 ratio. Back-crosses between F_1 plants and the susceptible parent produced 21 resistant to 25 susceptible plants, which falls within the range of expectation for a 1 : 1 ratio.

WARE (W. M.). **Mushroom-growing.**—*Bull. Minist. Agric., Lond.*, 34, 80 pp., 20 figs., 1938. 1*s.* 6*d.*

This is a fourth revised edition of the Ministry's bulletin on mushroom-growing [*R.A.M.*, xiv, p. 490]. New sections on the preparation of manure and the value of spent compost have been added by N. H. Pizer, and the bibliography is extended to six pages.

HINO (I.). **Fruit-body of 'bukuryô'.**—*J. Jap. Bot.*, xiii, pp. 672–674, 2 figs., 1937. [Japanese, with English summary. Abs. in *Jap. J. Bot.*, ix, 3, p. (106), 1938.]

The author has been convinced of the validity of the scientific name

of *Pachyma cocos* [*R.A.M.*, ix, p. 572] for the Japanese 'bukuryô' by a comparative examination of a native specimen and herbarium material in the Natural History Museum, Paris, as well as by observations on the fruit body of the former.

Hasimoto (A.). **The fruit-body of Pachyma hoelen Rumph.**—*J. Jap. Bot.*, xiii, pp. 824–825, 2 pl., 4 figs., 1937. [Japanese, with English summary. Abs. in *Jap. J. Bot.*, ix, 3, pp. (105)–(106), 1938.]

A fresh sclerotium of Japanese 'bukuryô' (*Pachyma hoelen*) [*P. cocos*: see preceding abstract] was kept perfectly dry for about a month and then embedded in wet sand for two years, water being added at regular intervals. At the end of this period, about one-tenth of the whole sclerotium was exposed, while the remainder was left embedded in the sand without any further addition of water. After some time a white, mould-like growth began to appear on the surface of the sclerotium and ultimately developed into a fruit body of *P. cocos*, otherwise almost unattainable.

Reports from the General Experimental Farms 1937.—*Pamph. Dep. Agric. Tanganyika* 21, 39 pp., 1938.

The following item of phytopathological interest occurs on p. 9 of this report. In further experiments in the isolation of cassava lines resistant to, or tolerant of, mosaic [*R.A.M.*, xvii, p. 649], seedlings remaining healthy when grown between rows of diseased setts in 1936 (the so-called 'bombardment' tests) were subjected to similar trials in field plots in 1937. Little infection occurred at first, but on pruning many plots succumbed, and only 7 per cent. remained free from either of the mosaic strains. Two imported types, however, show promise of resistance, namely, Kru from the Gold Coast and Turkey Claw from Trinidad, the latter remaining healthy even under 'bombardment'.

Moreau (L.) & Vinet (E.). **La défense du vignoble.** [The defence of the vineyard.]—220 pp., 47 figs., Paris, Librairie Ernest Flammarion, 1938. 18 francs.

This practical handbook gives concise descriptions of the diseases and pests of the vine, with instructions for their control. Chapters are also devoted to the resistance and susceptibility of various stocks to disease, cultural methods of improving vigour, critical periods of infection, spray warning services, and general considerations of control methods.

Adam (D. B.). **The injury of Grapevines by lightning strike.**—*J. Aust. Inst. agric. Sci.*, iv, 3, pp. 162–164, 1 fig., 1938.

Vines of the Grenache variety, believed to have been struck by lightning, at Watervale, South Australia, exhibited defoliation, death, and greyish discoloration of the tops of a large proportion of the vertical shoots. The plants in the centre of the affected area were not entirely killed, for fresh shoots were growing from their bases. Many of the leaves on vines at the edge of the area were bright red and the cortical tissues of the stems, especially in the internodal region, were dead and split; beneath these dead tissues abundant callus developed, causing

enlargement of the node. Browning of short sections of the veins occurred on many leaves, and sometimes bunches of grapes were severely russeted and the berries split. Numerous fungi were observed on the dead tissues.

PERCHER (G.). **Quelques essais sur les soufres et sur les mouillants.** [Some experiments on sulphurs and wetters.]—*Rev. Vitic., Paris*, lxxxix, 2309, pp. 295–300, 2 graphs, 1938.

In experiments on the control of vine *Oidium* [*Uncinula necator*: *R.A.M.*, xvii, p. 726] the best results were given by dusting with flowers of sulphur. Applications of a 2 per cent. cupric spray plus flowers of sulphur incorporated by means of a commercial product 'A' gave satisfactory control but this treatment is not recommended alone, though the use of such a mixture with a smaller proportion of sulphur may well be successful against mildew [*Plasmopara viticola*] as well as *U. necator*, dusting with cupric sulphur being intercalated as required.

Studies are also reported on the wettability and adherence of three commercial wetters, A (as used above), B, and C. Laboratory tests with a Duclaux pipette showed that the wettability conferred by all three used at the usual dosages was less than that of black or even white soap. Used at the rate of 100 c.c. per hectol., mixture C gave the greatest wettability, followed by A and then by B, and field observations indicated a similar sequence; at double this concentration the corresponding order in laboratory tests was A, C, B. Examination by electrolysis of the deposits left on leaves sprayed at the weaker concentration showed that deposits of B, A, and C contained, respectively, 40, 32, and 25 mg. of metallic copper, adhesiveness thus being inversely proportional to wettability.

VAN POETEREN (N.). **Verslag over de werkzaamheden van den Plantenziektenkundigen Dienst in het jaar 1936. Verslag over de werkzaamheden van den Plantenziektenkundigen Dienst in het jaar 1937.** [Reports on the work of the Phytopathological Service in the years 1936 and 1937.]—*Versl. PlZiekt.Dienst Wageningen*, 87, 84 pp., 4 pl., 1937; 89, 82 pp., 4 pl., 1938. [Received January, 1939.]

The following are among the numerous items of interest (apart from those noticed from other sources) in these reports, compiled on the usual lines [*R.A.M.*, xvi, p. 299]. Brown heart of swedes occurred in several localities in 1936 and was partially or completely controlled in experimental plots by the application to the soil of borax [ibid., xvii, p. 284] or Chile saltpetre.

Young plum and cherry trees (under ten years) were attacked during the same year by *Bacillus spongiosus* [*Pseudomonas spongiosa*: ibid., xiii, p. 642] in a virulent form, and also suffered from crown die-back due to *B.* [*P.*] *mors-prunorum* [ibid., xviii, p. 88].

In 1936 *Sclerotium delphinii* severely attacked lilies growing in a plot occupied by irises in the previous year [ibid., xiv, p. 147 and below, p. 182].

The failure of a pea crop in 1937 is tentatively attributed to *Sclerotinia libertiana* [*S. sclerotiorum*], the occurrence of which on this host is somewhat exceptional [ibid., xv, p. 477; xvi, p. 435; xvii, p. 588].

Hitherto the symptoms of crown gall (*Bacterium tumefaciens*) on beets [ibid., xvi, pp. 235, 303; xvii, pp. 99, 659, *et passim*] were restricted in Holland to the roots, but in 1937 the pathogen was also found on the leaves. Severe mosaic symptoms were transmitted, evidently by insects, from beet to an adjacent spinach planting [ibid., xii, p. 673] in North Brabant. Other records for 1937 are as follows.

Chlorosis and premature death of flax plants were caused by *Phoma herbarum* [ibid., viii, p. 547], the pycnidia of which were found in abundance on diseased material.

Caraway [*Carum carvi*] plants with discoloured umbels yielding little or no seed were found to be infected by *Cercospora cari* [incorrectly cited as *C. carum carvi* in *R.A.M.*, iv, p. 312].

The meadow fescue [*Festuca elatior*] crop in an experimental grass planting was attacked by *Helminthosporium inconspicuum* [ibid., xii, p. 660], which may reduce the yield by up to two-thirds.

Cylindrocarpon radicicola [ibid., xi, p. 767; xvii, p. 113, *et passim*] was frequently isolated from damp, granular, brown lesions on the tuberous rhizomes of *Gloxinia* [*Sinningia speciosa*]. *Verticillium dahliae* was responsible for heavy damage among chrysanthemums [ibid., xvii, p. 584]. Lilac was attacked by *Pseudomonas syringae* [ibid, xiv, p. 319; xvii, p. 812], the development of which was no doubt favoured by the heavy rains during the winter of 1936–7. The leaves of a consignment of orchids (*Oncidium varicosum* var. *rogersii*) at Aalsmeer, imported from the Argentine, bore the unmistakable symptoms of a rust (*Hemileia oncidii* or *H. americana*), not previously observed in Holland. Satisfactory control was obtained by sponging the foliage with methylated spirit. *Pythium megalacanthum* [ibid., xvii, p. 374] caused extensive decay at Zouterwoede of the cuttings of various ornamentals, including chrysanthemums, *Pelargonium*, and *Primula*.

Italian poplars [*Populus nigra* var. *italica*] at Elst suffered heavy defoliation in August, 1937, as a result of infection by *Marssonina populi* [ibid., xv, p. 618]. The perithecial stage of the fungus (*Trochila* [*Pseudopeziza*] *populorum*) is formed on the dead leaves, which in nurseries should therefore be collected and burnt. Dead branch-tips should also be destroyed and two applications of Bordeaux mixture given, one just after the unfolding of the leaves and another when they are fully grown. Similar measures are recommended for the control of *M. salicicola* on weeping willows [*Salix babylonica*: ibid., xi, p. 139], the perithecial stage of which, however, has not been observed in Holland.

In the section devoted to experimental and research work mention may be made of the following items. *Fusarium avenaceum* was found to be the predominating organism in the diseased roots and discoloured stem bases of peas affected by foot rot [ibid., xvii, p. 432]; *F. sporotrichioides* [ibid., xi, p. 17] occurred twice and *F. culmorum* [ibid., xiv, pp. 613, 720] once. Full details are given of the operation of the potato blight [*Phytophthora infestans*] warning service [ibid., xiv, p. 13 *et passim*]. Two virulent rots of gladiolus corms are gaining ground, one caused by *F. oxysporum* var. *gladioli* [ibid., xvi, p. 335] and the other, falling into six types, by *Botrytis* spp. [ibid., xi, p. 244]; both disorders affect numerous popular varieties. Notes are given on preliminary tests with various plant protectives.

RUSZKOWSKI (J.), ZWEIGBAUMÓWNA (Mme Z.), & BLOCKÓWNA (Mme H.). **Stan zdrowotności roślin uprawnych w Polsce w roku 1937.** [Diseases of cultivated plants in Poland in 1937.]—*Roczn. Ochr. Rośl.*, v, 4, pp. 49–102, 1938.

Apart from the many well-known diseases mentioned in this report, it is stated that spindle tuber [*R.A.M.*, xviii, p. 50] and witches' broom of potato occurred in the Warsaw district.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, xlix, pp. 559–563, 6 figs., 1938.

Up to 1938, maize smut (*Ustilago zeae*) had occurred in New South Wales only in plots of maize grown under quarantine conditions, but in that year the disease caused extensive damage in a small area of commercially grown maize in the Bathurst district. The crop was later burned, and steps were taken to minimize the spread of spore material from the affected area.

Under the conditions prevailing in New South Wales the most suitable lettuce varieties resistant to downy mildew (*Bremia lactucae*) would appear to be Imperial D and F [*R.A.M.*, xvi, p. 550; xviii, p. 7], the former being best suited for winter conditions, and the latter for summer. If susceptible lettuces are grown in a seed-bed before being transplanted, infection can be materially reduced by spraying with Bordeaux mixture (1–1–10) during the first week of growth and again about four days before transplanting.

Internal cork of apples [ibid., xviii, p. 117] and cracking and die-back of pears have occurred for many years in New South Wales [ibid., xvi, p. 819], where both conditions readily respond to a soil dressing of 1 lb. of borax per tree.

SU (M. T.). **Report of the Mycologist, Burma, Mandalay, for the year ended 31st March 1938.**—10 pp., 1938.

The following are among the items of interest in this report [cf. *R.A.M.*, xvii, p. 444]. In one rice field, a plot receiving adequate water was only mildly affected by *Helminthosporium oryzae* [*Ophiobolus miyabeanus*], while an adjacent plot receiving less water was more severely infected. Over a number of years the disease has always been moderate on one experimental plot which receives abundant water, except in one season when there was a scarcity of rain and 'dry sowing' was adopted; on this occasion infection was heavy.

Laboratory tests showed that spores from sclerotia of *Ustilaginoidea virens* [loc. cit.] collected in December germinated up to but not after the following August.

A new disease of rice, associated with a species of *Pyrenochaeta*, produced a brown discoloration of the tissue just below the point of attachment of the leaf blade to the sheath, the blade being eventually shed. Much defoliation was caused when the disease occurred early.

Sugar-cane top rot, from the lesions of which a strain of *Fusarium moniliforme* [*Gibberella fujikuroi*] was isolated, was observed on a large scale for the first time in Burma. In one locality *Cercospora kopkei* [ibid., xv, p. 346] was very prevalent on the Co. 213 variety.

A fungus of the *F. vasinfectum* type isolated from wilted cotton plants was shown by inoculation experiments to be a virulent parasite.

Groundnuts were affected for the first time locally by a wilt disease, associated with *Macrophomina phaseoli* [ibid., xv, p. 648; xvi, pp. 87, 493], and a species of *Diplodia*.

Tobacco leaf curl [ibid., xviii, p. 90], first observed in 1935, caused 6·9, 3, and 1·1 per cent. infection, respectively, on the cigarette varieties Harrison Special, H. 142, and Adcock; the local Burmese variety showed 0·9 per cent. affected plants.

The incidence of mildew of betel vines (*Piper betle*), caused by a species of *Oidium*, was reduced from 10·32 to 8·12 per cent. by an application of a 0·5 per cent. suspension of a proprietary colloidal sulphur, the disease increasing in the unsprayed plot from 3·12 to 39 per cent. within a month.

In mangosteens (*Garcinia mangostana*) submitted to various treatments and placed in storage at 40° to 50° F., the lowest amount of rotting after one month was found in the lots wrapped in iodized paper. At room temperature (80°) the chief decay organism was *Diplodia* [*natalensis*: ibid., xvii, p. 445], followed by *Phomopsis* sp., and then by *Pestalozzia*, whereas at the lower temperature range this order was reversed. In many instances, infection began at the stem end.

In experiments with the edible straw mushroom (*Volvaria diplasia*) [ibid., xvi, p. 154] no difference in yield was obtained by inoculating each layer and alternate layers of straw. Fresh spawn gave a higher yield than old, and the use of spawn over four months old was uneconomical. An improved method of making spawn was devised, by which a culture of the fungus grown on Quaker oats agar was inoculated into bottles of autoclaved straw. Spraying the beds with 5 per cent. formalin solution directly infection by *Corticium* sp. [loc. cit.] was noted suppressed the disease and increased the yield. Attempts to cultivate *Agaricus* [*Psalliota*] *campestris* were unsuccessful at Mandalay, but gave very good results at Maymo. The best crops were obtained when the atmospheric temperature did not pass above 76° or below 39°.

New records for Burma, in addition to those already mentioned above, included *Oidiopsis taurica* on tomato and eggplant [ibid., xviii, p. 83].

DEIGHTON (F. C.). **Mycological work.**—*Rep. Dep. Agric. S. Leone, 1937*, pp. 45–47, 1938.

This report [cf. *R.A.M.*, xvii, p. 161] contains, *inter alia*, the following items of interest. Further search for citrus scab (*Sphaceloma fawcettii* [*Elsinoe fawcetti*]) [loc. cit.] revealed its presence in only a very few localities in Sierra Leone. The few severely affected trees were destroyed, and those more lightly infected pruned. Pink disease (*Corticium salmonicolor*) was first recorded on citrus in Sierra Leone in December, 1937, a large seedling grapefruit tree being affected. The same disease was noted on cacao. A foot rot of a tangerine was associated with *Nectria flavolanata* [ibid., vii, p. 13].

Grapefruit trees at Freetown and Moyamba were affected by a disease of obscure origin resembling leprosis [ibid., xviii, p. 101], associated in the former locality with a *Colletotrichum*, probably present as a secondary infection, and in the latter with a *Pestalozzia*. Raised,

circular, light biscuit-coloured spots up to about $\frac{1}{4}$ in. in diameter, with a distinct margin, appeared on the young twigs and sometimes coalesced. Occasionally, a few pale brown spots appeared on the leaves and became perforated. In all other respects the trees were normal, and no economic importance is attached to the condition.

Tobacco leaf curl [see preceding abstract] was observed in three localities and is probably widespread, as leaf enations were noted on numerous wild plants, particularly *Stachytarpheta*. At Njala, Malayan varieties of beni (*Sesamum* sp.) and okra [*Hibiscus esculentus*] showed similar symptoms.

Plasmopara viticola was recorded on a wild host, *Cissus* [*Vitis*] *caesia*.

Cultures of *Myrothecium roridum* [ibid., xvii, p. 590] from Sierra Leone collections on leaves of *Dolichos lablab* and *H. esculentus* were ascertained by N. C. Preston to be strongly pathogenic to *Viola*, though a similar fungus from *Trichosanthes* was not pathogenic to this host.

New host records of *Macrophomina phaseoli* were African marigold (*Tagetes erecta*), *Cosmos sulphureus*, and *Zinnia*. Yam (*D*[*ioscorea*] *alata*) was affected by a mosaic disease, probably due to a virus. Records of entomogenous fungi, identified by Petch, included *Aschersonia badia* on aleyrodids on *Ficus capensis*, *A. placenta* on *Aleuromarginatus tephrosia* on *Tephrosia vogelii*, and *Empusa fresenii* on aphids [ibid., xii, p. 553] on *T. candida*.

Botany and plant pathology section.—*Rep. Ia agric. Exp. Sta., 1937–38*, pp. 103–121, 1938.

In further studies conducted in Iowa by H. C. Murphy, Mutica Ukraina (C.I. 3259) oats were found to be almost immune from races 33, 34, and 45 of crown rust [*Puccinia lolii*: *R.A.M.*, xvii, pp. 439, 664, 737], which attack the Bond variety, and from race 41, the only race to which Victoria oats are susceptible. Wild oats [*Avena fatua*] and a native strain from Uruguay (C.I. nos. 3416 and 3422, respectively), were almost immune from races 1 and 45.

In work by C. S. Reddy, only a trace of potato scab [*Actinomyces scabies*: ibid., xviii, p. 52] developed in field plantings of the resistant selection Minn. 35–26, U.S. 46000, U.S. 528–48, and U.S. 528–194, and the new variety, Houma, which has proved highly valuable in Louisiana.

C. M. Nagel states that sugar beet leaf spot (*Cercospora* [*beticola*: ibid., xvii, p. 719]) did not result in heavy reductions in yield or sucrose content in Iowa during 1937, although weather conditions strongly favoured infection, and the mildness of its effects is attributed to late planting (15th May to 15th June). Wider spacing gave control in experimental plots.

In studies by I. E. Melhus, Reddy, and W. F. Buchholtz, plantings of lucerne and red clover [*Trifolium pratense*] made on lucerne-sick land in four localities in southern, and four in central Iowa, gave poorer stands than plantings on land successfully planted to lucerne in the preceding five years. *Pythium de Baryanum* [cf. ibid., xv, p. 158] was isolated 55 times from 69 seedlings collected from the four fields in southern Iowa, and was also cultured from the soil and seedlings grown in soil collected from the four fields in central Iowa.

In the spring of 1938, 175 isolations from the roots of yellow, dwarfed oat seedlings grown in the field gave what appeared to be a species of

Pythium in 132 instances. When Gopher, Kanota, Iogold, Iowar, Iogren, D–67, Green Russian, and Swedish Select oats were sown in steamed soil inoculated with *P. de Baryanum* and *P. irregulare* [ibid., xvii, p. 476] the four last-named varieties gave under 60 per cent. germination under outdoor conditions in late March and the beginning of April compared with over 95 per cent. germination for all eight varieties on uninoculated steamed soil. Five weeks after sowing, the plants in the inoculated soil were very yellow, and by the seventh week they were also stunted, the basal leaves being dead, and the younger leaves dying from the tips down. The oats in the uninoculated soil, were green, showed only a few dead basal leaves, and were 6 to 8 in. higher. At 10° C., the Swedish Select variety gave 6 to 18 per cent. germination in soil inoculated with *P. de Baryanum* and 94 to 100 per cent. germination in uninoculated soil, while at 25°, the corresponding figures were 31 to 63 and 81 to 100 per cent. Root discoloration and necrosis were more severe at the lower than at the higher temperatures. In three experiments, intermediate temperatures gave intermediate results. Observations by Melhus, Reddy, Buchholtz, and Nagel showed that a total loss of sugar beets in one field resulted from late root rot due to *Aphanomyces cochlioides* [ibid., xvii, p. 428]; the disease became severe in four fields, and was present in over 25 per cent. of the fields round Kanawha by 1st July, 1937.

Melhus found that mulberry bacterial blight (*Pseudomonas* [*Bacterium*] *mori*) [ibid., xvi, p. 785] occurred on 25 to 75 per cent. of trees under an overhead irrigation system, infection causing slight leaf fall, with severe shot hole on most of the trees, whereas non-irrigated trees were only slightly affected.

A speedy test for the presence of the bacteriophage of *P.* [*Bact.*] *tumefaciens* [ibid., xvii, p. 659] in herbaceous plants was devised, in which sections of the stem are ground in sterile mortars with 10 to 15 c.c. of sterile distilled water, and allowed to extract for 15 minutes, after which the material is passed through a sterile Chamberland-Pasteur L3 filter candle. Inoculation of the sterile filtrate on to plates pre-seeded with *Bact. tumefaciens* produces plaques when the bacteriophage is present in the plant. By this method the bacteriophage was isolated from gall tissues and stem tissues 15 in. above the galls. When tomato plants, the roots of which had been cut off under water, were put in a 48-hour-old culture, the bacteriophage was recovered after six hours from stem sections made up to 18 in. above the base, but after 72 to 96 hours, recovery of the bacteriophage was no longer possible. The few bacteria isolated from the plants at the same time were not found to be pathogenic. When tomato plants whose roots had been cut off under water were placed in a 48-hour-old, bacteriophage-free, bacterial culture, it was possible to recover the bacteria in six hours from stem sections up to 12 in. above the base of the stem and such bacteria were highly pathogenic. After 72 to 96 hours it was occasionally possible to isolate a weak bacteriophage from the stem sections.

SIEGLER (E. A.). **Relations between crown gall and P_H of the soil.**—*Phytopathology*, xxviii, 11, pp. 858–859, 1938.

In order to verify the hypothesis that relatively alkaline soils may

be a predisposing factor in crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) infection, four adjacent rows of acid soil in the Sacramento River Valley, California, were selected for planting peach seed; two alternate rows were limed in the autumn of 1937, and a week later all four were heavily inoculated with an aqueous suspension of the organism. In the following autumn the incidence of infection in the limed (P_H 6·8) rows was 32 and in the acid (P_H 5) 3 per cent.

NAGY (R.), RIKER (A. J.), & PETERSON (W. H.). **Some physiological studies of crown gall and contiguous tissue.**—*J. agric. Res.*, lvii, 7, pp. 545–555, 2 figs., 2 graphs, 1938.

Analyses made of the galls (*Phytomonas* [*Bacterium*] *tumefaciens*) [*R.A.M.*, xvii, p. 798] and contiguous tissue from tomatoes, red raspberry, and sugar beets, showed that the composition of gall tissue, which varied greatly according to the time of harvest and the species of plant, resembled generally that of young plants. The ash, total nitrogen, and simple forms of nitrogen were generally higher, and cellulose and pentosans lower, in the galls than in the uninfected tissue of tomato, whereas in sugar beets the galls had more cellulose and pentosans than the uninfected tissue. The glutathione content of the tomato galls was higher than that of the uninfected contiguous stem, but much lower than that of the growing tips, which also contained much more ascorbic acid. No considerable difference existed between the hydrogen-ion concentrations of the galls (P_H 5·72) and stems (P_H 5·79) of tomato. Calculated on the wet weight basis the catalase, oxidase, and peroxidase activity of the tomato galls were 160, 130, and 120 per cent. greater, respectively, than that of the contiguous stem tissues, the corresponding values when calculated on the basis of total nitrogen instead of wet weight being 86, 73, and 57 per cent, respectively. Alpha amino nitrogen and tyrosinase activity were, respectively, 20 and 200 per cent. greater in tomato galls than in the contiguous stems.

STAPP (C.). **Der Pflanzenkrebs und sein Erreger Pseudomonas tumefaciens. VI. Mitteilung. Asparagus sprengeri Rgl und Phaseolus vulgaris L. als Wirtspflanzen.** [Crown gall of plants and its agent *Pseudomonas tumefaciens*. Note VI. *Asparagus sprengeri* Rgl and *Phaseolus vulgaris* L. as hosts.]—*Zbl. Bakt.*, Abt. 2, xlix, 5–8, pp. 116–123, 6 figs., 1938.

Pursuing his studies on crown gall of plants (*Pseudomonas* [*Bacterium*] *tumefaciens*) [*R.A.M.*, xvi, p. 591], the writer reports the isolation of the organism from naturally occurring tumours on *Asparagus sprengeri* [ibid., xvi, p. 442] at the Dahlem Horticultural Institute and Juli beans (*Phaseolus vulgaris*) [cf. ibid., xvi, p. 799; xvii, p. 800] at a Mülheim (Ruhr) nursery.

The crown gall strain from *A. sprengeri* was also pathogenic to *Datura tatula*, sweet peas, tomato, sunflower, and *Pelargonium zonale*, whereas that from bean infected only its own host. The serological relationships of the two strains were also different, the *A. sprengeri* isolation agreeing in this respect with the *Dahlia variabilis* and *Chrysanthemum frutescens* strains, whereas that from bean gave divergent reactions. However, both strains formed stars in an iron-manganese-carrot juice medium and

their colour and morphological characters were identical. Evidence is adduced from comparative serological tests with named cultures of *Bact. tumefaciens* and inoculation experiments on known hosts of this organism that it, and not *Phytomonas fascians* [ibid., xviii, p. 33], is responsible for the development of tumours on *A. sprengeri*.

STAPP (C.) & MÜLLER (H.). **Der Pflanzenkrebs und sein Erreger Pseudomonas tumefaciens. VII. Mitteilung. Untersuchungen über die Möglichkeit einer wirksamen Bekämpfung an Kernobstgehölzen.** [Crown gall of plants and its agent *Pseudomonas tumefaciens*. Note VII. Investigations on the possibility of effective control in pome fruit orchards.]—*Zbl. Bakt.*, Abt. 2, xcix, 9–13, pp. 210–276, 13 figs., 3 graphs, 1938.

A comprehensive, fully tabulated account is given of the writers' recent investigations (in which they were assisted by F. Dame) at the Biological Institute, Dahlem, Berlin, on the practical possibilities of crown gall (*Pseudomonas* [*Bacterium*] *tumefaciens*) [see preceding abstract] control in apple and pear trees.

None of the 85 strains of the pathogen isolated directly by standard methods from apple and pear tumours [*R.A.M.*, vii, p. 231] showed any trace of virulence on inoculation into sunflower, *Pelargonium zonale*, and *Datura tatula*, and it was therefore necessary to secure inoculum for further tests by indirect means. Fragments of tumours from apple and pear were transplanted to sunflower, *P. zonale*, *D. tatula*, and tomato with positive results in six cases from pear to sunflower, in seven from pear to *D. tatula*, in one from apple to sunflower, and in seven from apple to *D. tatula*. The strains isolated in pure culture on bouillon agar from the excrescences thus induced were of only moderate virulence [cf. ibid., xiv, p. 740; xvii, p. 800], and showed less resistance to plant-protectives than the avirulent strains from apple and pear. A semi-total or complete loss of infectivity ensued when virulent cultures of *Bact. tumefaciens* were placed for periods of $1\frac{1}{2}$ hours and upwards in extracts from the outer tissues of apple tumours before transference to an iron-manganese-carrot juice solution and subsequent inoculation into sunflower. Crown gall tumours on the apple thus appear to contain a substance causing an appreciable regression of pathogenicity in *Bact. tumefaciens*, a fact explaining the lack of virulence of most strains of the organism from pome fruits. The addition of α-alanin, a decomposition product of albumin, at the rate of 0·1 to 0·3 per cent., to a bouillon medium (diluted 1 : 10), induced a similar decline of virulence [ibid., xvi, p. 369], especially in the pear and hop strains, but whether this substance is identical with the inhibitory element in apple tumours is as yet unknown.

The different strains of *Bact. tumefaciens* used in these experiments varied in their pathogenicity towards apple and pear, the most virulent being that from hops, while no infection on either host was caused by the *Chrysanthemum frutescens*, willow, gooseberry, honeysuckle, or two free pear stock strains. The dahlia strain occupied an intermediate position, attacking one out of six apples and four out of seven pears (free stocks in both instances). Pears further proved moderately susceptible to infection by a crown gall strain from asparagus and two

from 'mauke'-diseased vines [ibid., xiv, pp. 499, 676, 740], all three of which were also pathogenic to *P. zonale* and tomato.

In experiments in 1937 the length of the incubation period of *Bact. tumefaciens* on pome fruits was found, in agreement with American work, to vary at different seasons. The shortest incubation period of 15 days was obtained for both apples and pears for inoculations performed at the height of summer (June–July) and the longest of 45 days, for apples in early spring. For pears the incubation period in spring and autumn was shorter than that for apples.

Bact. tumefaciens was shown to 'migrate' for considerable distances from the original foci of infection in its hosts, e.g., 120 cm. in an inoculated plant of *D. tatula* and up to 8 cm. above the galls on the roots of naturally diseased free pear stocks. The excision of the tumours thus affords no guarantee of actual freedom from infection, while free apple stocks, pruned back to the sound wood and grown in sterile soil, showed up to 35 per cent. crown gall at harvest time. Mechanical means of control are therefore ineffectual against crown gall, and the same was found to be true of 'physiological' measures, consisting in attempts to diminish the susceptibility of free apple and pear stocks in four nurseries comprising 30,000 trees by reducing the nitrogen and increasing the potash and phosphoric acid supplied. In laboratory tests the incorporation in a sterile soil medium of avirulent strains of *Bact. tumefaciens* from apple, pear, and rose with the virulent dahlia isolation led to a decline of infectivity in the latter, but in field experiments in infested soil a similar procedure gave negative results.

In 1936 and 1937 trials were carried out at the Biological Institute and several nurseries to ascertain the practicability of combating crown gall in free pear and apple stocks by various chemical preparations which had given promising results in preliminary laboratory tests. The influence of sulphur was found to depend largely on the reaction and buffering capacity of the treated soil, damage being caused to the plants by the application of as small a dose as 50 gm. per sq. m. to acid soils. Moreover, at the rate of 50 to 100 gm. per sq. m. sulphur is not entirely effective against crown gall, while larger quantities are apt to be injurious. Lime should be given during the previous autumn, and not simultaneously with the sulphur. The admixture of sulphur bacteria (*Thiobacillus thiooxydans*) with the sulphur was not as a rule beneficial. Of the 'dips' tested, 1 per cent. ceresan liquid (U 564a) in loam emulsion gave particularly satisfactory results, even better than uspulun (Saatbeize), which is apt to cause injury to the plants at 2 per cent. Uspulun-universal proved to be quite unsuitable for the purpose in view. In seed-bed tests 0·5 per cent. ceresan (10 l. per sq. m.) or sulphur (strewn over the surface at the rate of 50 gm. per sq. m.) definitely stimulated the emergence and vegetative development of the seed. With abavit-liquid the best results were obtained at 0·2 per cent.; this preparation, 1 per cent. ceresan, or 1 per cent. uspulun (Saatbeize) will give adequate control in slightly infested areas, whereas on very heavily contaminated plots the only completely efficacious substance was the highly toxic and altogether unsuitable mercuric chloride (15 to 20 gm. per sq. m.). It is therefore inadvisable to cultivate pome fruits in badly infected sites; elsewhere in the nursery a combination of soil

disinfection with sulphur (50 to 100 gm. per sq. m.) and immersion of the well-trimmed stocks in one of the above-mentioned fungicides may be recommended as the most practical method of crown gall control.

MATSUMOTO (T.) & SAWADA (Y.). **Bacteriophage specific for Bacillus aroideae.**—*Trans. nat. Hist. Soc. Formosa*, xxviii, 178, pp. 247–256, 1 fig., 1938.

The bacteriophage of *Bacillus* [*Erwinia*] *aroideae* was isolated from an aqueous suspension of crushed diseased radishes kept for about a fortnight at 10° C. It was experimentally shown to be specific in reaction. The potency of the lytic principle does not vary to any appreciable extent between 22° and 28° C., but a maximum appears to be generally reached at about 25°, a point considerably lower than the optimum for bacterial growth (28° to 31°). The plaques produced by the phage are very small (0·1 to 1, mostly under 0·5 mm.) on neutral potato dextrose, bouillon, or other agar media, of which the first-named, at a concentration of 2 per cent., was found to be the best for the production of clear, lytic spots.

BECK (E. C.). **The application of serological methods to the differentiation of closely related smut fungi.**—*Canad. J. Res.*, Sect. C, xvi, 10, pp. 391–404, 1938.

In further studies on the differentiation of closely related smuts by means of the reciprocal precipitin-ring test [*R.A.M.*, xiii, p. 435] antisera were prepared for *Ustilago avenae*, *Sorosporium reilianum*, *Sphaerotheca sorghi*, *U. zeae*, and *U. hordei* and were found to react specifically to extracts of the various fungi. The titre of an antiserum is defined as the highest dilution in which a continuous precipitin ring occurs between undiluted antiserum and its homologous antigen, and for the fungi studied the lowest titre was 1 in 3,200 whilst six possessed a titre of 1 in 12,800. Extracts of three monosporidial cultures of *U. zeae* (A, B, and C) isolated from a single chlamydospore and of two monosporidial cultures of *U. hordei* (A and B) also from a single chlamydospore, were distinguished as separate serological entities. Three antisera of *U. zeae* gave strong group reactions with *U. avenae* antigen but the antiserum of *U. avenae* was not reciprocally reactive with the antigens of *U. zeae*. The antiserum of *Sorosporium reilianum* gave marked group reactions with most of the antigens of other cultures, but the antisera of these cultures were not proportionately reactive with the antigen of *S. reilianum*. On the basis of these results it is concluded that the differences between titres of the antisera and non-specific reactions are great enough to serve as a basis for the identification of the members of this group. The only exceptions were *U. hordei* B and its mutant *U. hordei* C, which were found in two series of tests and in a reciprocal absorption test to be serologically identical. The optimal proportions of antigen and antibody for the reciprocal absorption test were found to be 1 : 10 and 1 : 1·25, respectively, but could not be used in absorption tests because of the dilution of the antiserum by the antigen. The agglutination test and the Widal or microscopical agglutination test were applied but gave unsatisfactory results.

RICEMAN (D. S.), DONALD (C. M.), & PIPER (C. S.). **A copper deficiency in plants at Robe, South Australia. 1. Preliminary investigations on the effect of copper and other elements on the growth of plants in a 'coasty' calcareous sand at Robe, South Australia. 2. The occurrence of reclamation 'disease' in cereals in South Australia.**—*Pamphl. Coun. sci. industr. Res. Aust.* 78, 28 pp., 6 pl., 1 fig., 1 graph, 1938.

In the first of these papers, Riceman and Donald give a fully tabulated account of investigations conducted in South Australia into copper deficiency-induced reclamation disease of wheat, oats, and barley in an area of blown calcareous sand, a preliminary description of which has already been noticed from another source [*R.A.M.*, xvii, p. 508].

In field tests carried out in 1937, 48 species of legumes, grasses, cereals, and other plants were sown in plots in the locality affected, the plots being given a basic dressing of 2 cwt superphosphate, 1 cwt sulphate of ammonia, and 2 cwt sulphate of potash per acre, and one of the following treatments: (1) cobalt chloride, 5 lb. per acre, (2) manganese sulphate and ferrous sulphate, each 28 lb. per acre, (3) no treatment, (4) copper sulphate, 28 lb. per acre, (5) copper sulphate, manganese sulphate, and ferrous sulphate, each 28 lb. per acre, and cobalt chloride 5 lb. per acre. In general, copper sulphate, alone or in the mixture containing it, markedly increased growth or period of survival. Manganese and iron produced only slight differences, chiefly limited to cereals, and cobalt chloride generally had a depressing effect. With lettuce, turnip, and tick bean (*Vicia faba*), the yield of the untreated plants in a given area was, respectively, 0·2, 13·2, and 4·7 gm. oven-dry weight, the corresponding figures for the copper-treated plants being 1·8, 45·7, and 46·7 gm., while the number of plants at the conclusion of the experiment in the same area in the untreated soil was, respectively, 3·3, 17, and 4·7 and in the copper-treated 12, 26, and 10·3. Of the cereals, rye developed normally without any treatment, and showed no response to the copper. The total yield (air-dry weight from a given area) of Gluyas wheat, Ghurka wheat, Mulga oats, and Prior barley from the untreated plots was 92, 29·3, 77·6, and 308·3 gm., respectively, the corresponding figures for the copper treatments being 317·4, 244·6, 293·4, and 350·8 gm. The mean total yield for all cereals except rye, per given area, amounted to 187·9 and 326·7 gm. in the untreated and copper-treated plots, respectively. In pot culture experiments, subterranean clover (*Trifolium subterraneum*) was grown in the soil in question with the addition of superphosphate only, superphosphate and potassium chloride only, and various minor elements mixed with the soil or sprayed in solution on the foliage, together with a basal dressing of phosphorus and potash. When the plants were harvested only those given copper plus cobalt were completely normal. The response to copper-cobalt applications would appear to be due to the former element.

In the second paper, Piper describes an experiment in which oats were grown in pots containing soil from the same locality, to some of which manganese sulphate was added. The manganese-treated plants remained healthy for about 14 weeks, while the others developed characteristic symptoms of manganese deficiency, but after 18 weeks all the plants developed symptoms of reclamation disease. Copper

sulphate was then applied to three pots, which quickly showed marked improvement, though the disease grew worse in the pots not receiving the copper. All the plants in the copper-treated pots finally showed greater weight of total dry matter than the controls.

In a field test in which copper sulphate was applied at the rate of 1 cwt per acre to oats in untreated soil and soil treated with manganese sulphate, the plants in both copper-treated parts recovered from the disease and produced normal ears, while the plants not treated with copper failed to ear. Oats growing in a portion of the paddock treated at sowing with a mixed fertilizer containing superphosphate, potash, copper sulphate, borax, and zinc sulphate were quite healthy, though the surrounding plants, in untreated soil, failed completely.

Sass (J. E.). **Abnormal mitosis in seedlings of some Gramineae following seed treatment.**—*Amer. J. Bot.*, xxv, 8, pp. 624–627, 20 figs., 1938.

A histological study of the root-tip cells of maize seedlings following four hours' immersion of the kernels and subsequent moistening of the root tips in a 1 in 2,000 suspension of ceresan [*R.A.M.*, xvi, p. 377] showed hypertrophy and abnormal mitosis in meristematic cells, attributed to the toxic action of ethyl mercury phosphate. During the prophases the nucleus seemed to be comparatively inert to the poison, but drastic disturbances took place during the anaphase, characterized by the formation of multipolar spindles and an irregular or incomplete separation of split chromosomes. The result of aberrant polarity during mitosis and aberrant anaphase separation, usually associated with the failure of cell-plate formation, was the production of giant cells, either multinucleate or with giant nuclei.

Similar abnormal cell division was observed in all meristematic regions of seedlings of *Avena strigosa* and *Holcus sorghum* grown from heavily dusted grain. The axillary buds in the germinating embryo of *A. strigosa* had multinucleate cells and polyploid nuclei.

Boewe (G. H.). **Naucoria on small grains in Illinois.**—*Phytopathology*, xxviii, 11, pp. 852–855, 1 fig., 1938.

English and Latin diagnoses are given of *Naucoria cerealis* n.sp., a weak parasite of wheat, barley, and rye in Illinois [*R.A.M.*, xvii, p. 737]. It is characterized by a thin, hemispheric, later expanded pileus, sometimes with a depressed centre and downward-turning margin, 1 to 2·2 cm. broad, glabrous, light buff, flesh whitish; adnate, broad, thin, chestnut-coloured lamellae; golden-brown spores, oval in one view but asymmetrically oval in the other, with a gelatinous apicule covering the germ pore, smooth, 9·9 to 16·5 by 6·9 to 9·9 μ, generally 12·5 to 13·5 by 7 to 8·5 μ; and a stipe equal, slightly bulbous at the base, glabrous, light buff, stuffed, becoming hollow, the upper part striate, 2 to 4·6 cm. long, and 1 to 1·5 mm. thick.

Straib (W.). **Ergebnisse und Probleme der Getreiderostforschung.** [Results and problems of cereal rust research.]—*Angew. Bot.*, xx, 5, pp. 349–365, 1938.

This is a critical review and discussion of the work already accom-

plished and that remaining to be done on some outstanding problems of cereal rust (*Puccinia* spp.) research, with special reference to German conditions, e.g., physiologic specialization, varietal resistance, environmental factors in relation to resistance, and inheritance of resistance [cf. *R.A.M.*, xvi, p. 235].

VANTERPOOL (T. C.) & SIMMONDS (P. M.). **The relation of browning root rot to stem rust in causing injuries to Wheat.**—*Sci. Agric.*, xix, 2, pp. 81–82, 1938.

The results of observations in 1938, in a wheat field at Saskatoon, Saskatchewan, which earlier in the season had shown considerable browning root rot (*Pythium* spp.) [*R.A.M.*, xvii, p. 796] in certain well-known diseased areas, showed that on 3rd August the wheat in the healthy areas was quite mature (kernels in the dough stage and most of the straws ripe), and only a trace of stem [black] rust (*Puccinia graminis tritici*) was present on the plants. In the diseased areas, on the other hand, the wheat kernels were in the late milk stage and the plants green; the rust on these plants was estimated at 20 to 30 per cent., extending up to the peduncle and head. On 11th August, when the crop was being cut, the plants in the healthy areas were estimated to be 90 per cent. mature, with the kernels in the firm dough stage, and with only a trace of rust on the straws. The threshed grain gave a yield of 33 gm. per 50 heads, and weighed 61·2 lb. per bush., being graded a poor No. 1 on account of some green kernels. In the diseased areas, however, the plants were still quite green, and the kernels in the late milk or early dough stage; rust was estimated at 35 to 40 per cent. The yield was 24·95 gm. per 50 ears, and the grain weighed 57·2 lb. per bush. and graded a good No. 4. While admittedly only indicative, the data suggest that had it not been for the delay in maturity caused by the root rot, the damage from rust would have been negligible and the grain of good quality. This is in agreement with the experience of many farmers from time to time during the last 20 years and with the established observations of plant pathologists.

LUNGREN (E. A.) & DURRELL (L. W.). **Black stem rust control in Colorado.**—*Bull. Colo. agric. Exp. Sta.* 447, 18 pp., 7 figs., 3 maps, 1938.

In this paper the authors report the progress made in the barberry (*Berberis* spp.) eradication campaign against black stem rust (*Puccinia graminis*) of grain crops in Colorado, where the annual loss due to this disease is put at 335,000 bush. of small grains. Locally, the chief sources of early infection are *B. vulgaris* and *B. fendleri* [*R.A.M.*, vi, p. 471]. Epidemics affecting several square miles may arise from a single barberry bush. Wind-borne spores from neighbouring States sometimes reach Colorado in time to damage grain crops before they mature, but infection from this source generally appears from two to three weeks after that which develops in the vicinity of local barberries. Besides barberry eradication and the use of rust-resistant varieties, it is recommended that spring wheat should be sown as soon as the soil can be made ready.

LESZCZENKO (P.). **Badanie nowych środków do zaprawiania zbóż przeciw grzybkom głowniowym.** [Tests of new cereal seed disinfectants against smut fungi.]—*Roczn. Ochr. Rośl.*, v, 4, pp. 103–108, 1938.

In tests carried out in 1937–8 in Poland, seed-grain of Trotzkopf wheat and Puławskie rye was artificially inoculated with spores of *Tilletia tritici* [*T. caries*: *R.A.M.*, xv, p. 285] and *Urocystis occulta* [loc. cit.], respectively, and treated with various disinfectants. The untreated controls yielded an average for the two years of 37·2 per cent. affected wheat ears and 39·15 per cent. diseased ears of rye, the corresponding figures for treatment with formaldehyde (0·1 per cent. solution, 30 minutes' soaking) being 0·25 per cent. for both wheat and rye, for abavit (0·2 per cent. solution) 0·25 per cent. for wheat and 0·35 per cent. for rye, and for the same (0·3 per cent. solution) 0·1 per cent. for both wheat and rye. Ziarnik, zbożak, and uspulun used in a 0·2 per cent. solution were ineffective, but at a strength of 0·3 per cent. the results were nearly as good as those obtained with formaldehyde.

SEMPIO (C.). **Su un caso sperimentale di netto antagonismo in vivo ('Tilletia caries'—'Erysiphe graminis' su 'Mentana').** [On an experimental case of distinct antagonism *in vivo* (*Tilletia caries*—*Erysiphe graminis* on Mentana).]—*Riv. Pat. veg.*, xxviii, 9–10, pp. 377–384, 1 fig., 1938.

In this preliminary account of his investigations, the author states that on 3rd March, 1937, he planted 60 to 70 healthy seeds of Mentana wheat in each of three pots and the same number of seeds heavily infected with *Tilletia caries* [see next abstracts] in three others. On 4th April, all the seedlings were abundantly infected with a suspension of the conidia of *Erysiphe graminis*, placed in a damp chamber for 48 hours, and then kept at a relative humidity of 80 to 95 per cent. for the remainder of the experiment.

On 16th April, all the plants were observed to show infection by *E. graminis* but those grown from the clean seeds were more severely attacked than those from the bunted seeds. This difference became progressively more marked, and by 25th April, many of the plants from the clean seed were dead, while those from the bunted seed were only severely mildewed. All the seedlings were then dusted with sulphur, the operation being repeated a few days later. When the ears had matured, the seedlings grown from the bunted seed showed 185 ears (18 clean and 167 bunted), while those from the clean seed had only 52 ears.

The author considers that *T. caries* probably liberated substances toxic to the mildew and also stimulated the powers of resistance of the wheat.

SEMPIO (C.). **Effetto delle alte temperature sul Frumento cariato al momento della spigatura.** [The effect of high temperatures on bunted Wheat at the time of earing.]—*Riv. Pat. veg.*, xxviii, 9–10, pp. 385–387, 1938.

When wheat seedlings grown from seed heavily inoculated with spores of *Tilletia tritici* [*T. caries*] were exposed 8, 16, 30, and 60 days after sowing to a temperature of 32° to 33° C. until the booting stage was reached, the percentage of bunted ears that formed subsequently was

much lower than in the case of the inoculated controls not exposed to this temperature. Exposure of infected seedlings in a later stage of growth to the same temperature resulted in the ears that survived the treatment (approximately one-third of the number that formed in the unexposed controls) being mostly healthy, though almost all the unexposed control ears were infected. When three pots of seedlings grown from inoculated Virgilio seed were exposed to this temperature for 4, 5½, and 5½ days, the plants subsequently showed, respectively, 13, 1, and 5 completely bunted ears, 0, 0, and 3 partially bunted, and 5, 8, and 4 healthy, the corresponding figures for the unexposed controls being, 21, 37, and 30; 1, 0, and 0; and 0, 2, and 2. It would appear that infected wheat seedlings must remain exposed to a temperature of 32° for at least five consecutive days before *T. caries* is definitely arrested.

Sempio (C.). **Influenza di alcune sostanze, date alle piantine per assorbimento, sullo sviluppo della carie del Grano. (Nota preventiva).** [The influence of some substances, absorbed by young plants, on the development of Wheat bunt. (Preliminary note).]—*Riv. Pat. veg.*, xxviii, 9–10, pp. 399–400, 1938.

Seeds of Virgilio wheat heavily inoculated with spores of *Tilletia tritici* [*T. caries*] were sown in pots, and 60 days later the seedlings were transferred to a nutrient solution to which was added one of a number of various substances (including alkaloids, phenols, glucosides, and metals), the solutions being renewed at intervals of five days. After 20 days the seedlings were planted out in cement containers. When the ears had fully developed it was observed that the only substances that had exercised any definite effect on infection were nickel, cadmium, and salicylic acid which gave, respectively, 40, 40, and 26 completely bunted ears, 3, 6, and 1 partially bunted, and 8, 4, and 6 clean, as against 56 completely bunted, and no partly bunted or clean ears in the controls.

Dionigi (A.). **Sullo svernamento delle ruggine. (Nota II.).** [On the overwintering of rusts. (Note II).]—*Riv. Pat. veg.*, xxviii, 9–10, pp. 401–404, 1938.

In this paper on the mode of perpetuation of rusts (*Puccinia*) [*glumarum*, *P. graminis*, and *P. triticina*] [*R.A.M.*, xvii, p. 164] the author presents data considered to demonstrate that these rusts do not have continuous cycles of activity. He adduces further evidence of a dormant state for the uredospores of these rusts, based on the absence of infection of wheat sown in summer in soil inoculated with rust spores, whereas wheat sown in autumn in similar soil developed rust at the usual time.

Straib (W.). **Untersuchungen zum Verlauf der Herbstinfektion und Überwinterung des Gelbrostes auf Weizen und Gerste.** [Investigations on the course of autumn infection and overwintering of the yellow rust on Wheat and Barley.]—*Phytopath. Z.*, xi, 4, pp. 331–359, 4 graphs, 1938.

In field experiments, carried out from 1934 to 1938 at Gliesmarode, Brunswick, a large number of wheat varieties were artificially inoculated each autumn with the physiological races 2, 7, and 9 of *Puccinia*

glumarum [*R.A.M.*, xvii, pp. 231, 307], 12 varieties of barley inoculated with race 23 being included in the last experiment. Infection was favoured by mild, moist weather and consequently succeeded better in early sown wheats, and was also more profuse in wheat varieties with pendent leaves. 'Absolutely resistant and immune' varieties showed no infection, but those relatively resistant at 12° C. in the greenhouse test were fairly susceptible under conditions of low autumn temperatures in the field. All four races under consideration were found capable of overwintering on susceptible varieties of the appropriate hosts. The capacity for overwintering varied considerably in the different years, being apparently dependent on soil and weather conditions in February and March; the growth of mycelium and spore formation were arrested by wet, cold weather in spring, which killed the old leaves, the chief bearers of yellow rust. Under conditions of equal initial infection in autumn more rust overwintered on susceptible varieties, especially on those with pendent leaves, than on resistant; with varying degrees of initial infection the percentage of overwintering on susceptible varieties increased in proportion to the primary incidence of the disease.

The overwintering of rust under the climatic conditions of central and north Germany is considered to be less dependent on the winter-hardiness of a cereal variety than on the length of life of old autumn leaves, conditioned by factors of soil, weather, and nutrition. Slow growth of mycelium, long periods of incubation, and prolonged spore formation are of primary importance in the overwintering of the uredo stage. Secondary infection during the winter months was also observed, and was found to be particularly favoured by the higher infective capacity of winter uredospores, which also remained viable for a longer period than summer ones, an important factor in the epidemiology of the rust. Couch grass [*Agropyron repens*], which is generally resistant to rust infection in summer, was found to be heavily infected in autumn. In this respect it resembles the relatively resistant wheat varieties.

RALSKI (E.). **Die Empfänglichkeit des Weizens für den Braunrost Puccinia triticina Erikss.** [The susceptibility of Wheat to the brown rust *Puccinia triticina* Erikss.]—*Phytopath. Z.*, xi, 4, pp. 447–449, 1938.

An account of the work presented in this paper has already been noticed from another source [*R.A.M.*, xvi, p. 372]. Although none of the wheat varieties native to Poland was absolutely resistant to *Puccinia triticina* in the field, the native winter wheat Ostka Gruboklosa was found to be fairly resistant and the native summer variety Puławska Twarda highly resistant, while of the foreign wheats Carman l. and Rikuun, both of the infection type 1 to 2, deserve to be mentioned.

CHURCHWARD (J. G.). **Studies on physiologic specialization of the organisms causing bunt in Wheat, and the genetics of resistance to this and certain other Wheat diseases. Part ii. Genetical studies.** —*J. Roy. Soc. N.S.W.*, lxxi, pp. 547–590, 2 pl., 3 graphs, 1938.

In continuation of his earlier studies [*R.A.M.*, xvii, p. 804] the author has investigated the inheritance of resistance to bunt (*Tilletia tritici*) [*T. caries*], flag smut (*Urocystis tritici*), and two races of stem [black]

rust (*Puccinia graminis*) and certain morphological characters of the wheat cross Federation × Hope both in the greenhouse and in the field at Richmond, New South Wales, and at St. Paul, Minnesota. Field results obtained with five generations from one collection of *T. caries* indicated that in addition to a single major factor for resistance to bunt this cross probably possesses at least one minor modifying factor which allows the development of bunt in certain families. The resistance of the cross to *P. graminis* race 34 was determined in the field by at least two major factors and probably several important modifying ones; and in the greenhouse there was complete dominance of susceptibility to race 34 and dominance of resistance to race 33, the single factors involved being inherited independently of those for resistance in the field. The dominant reaction of the cross to *U. tritici* remained unknown in the absence of F_1 and F_2 data, but the results for the F_3 generation in the greenhouse indicated the operation of a single major factor for resistance. In this cross there was a loose linkage between the genes determining resistance to bunt and flag smut and also to race 34 of black rust in the field and late maturity, and a very weak linkage between resistance to bunt and resistance in the greenhouse to races 33 and 34 of black rust.

Discussing the recent advances in the genetics of bunt, the author stresses the importance of environmental factors in genetic studies, recommends the adoption of uniform criteria for susceptibility and resistance, and urges the standardization of experimental technique.

SALMON (S. C.). **Generalized standard errors for evaluating bunt experiments with Wheat.**—*J. Amer. Soc. Agron.*, xxx, 8, pp. 647–663, 5 graphs, 1938.

Data are presented from tests conducted by Rodenhiser and Holton in connexion with their studies on physiological races of wheat bunt [*Tilletia caries* and *T. foetens*: *R.A.M.*, xvii, p. 164] to determine varietal differences in infection which show that the estimation of random variation by analysis of variance, or by any method involving the grouping together of all varieties irrespective of bunt incidence, may be seriously in error when varieties differing materially in susceptibility are included. The binomial and chi-square determinations, as generally used for the evaluation of statistically significant differences, are also unreliable for bunt resistance tests, since they take into account only the random variation due to simple sampling and do not allow for environmental heterogeneity (principally in relation to soil differences).

The standard error was found to be largely dependent on the incidence of infection, approaching 0 at 0 and 100 per cent. and reaching a maximum at or near the 50 per cent. level. The introduction of a constant into the binomial formula to allow for random errors, other than those due to simple sampling, makes possible the fairly accurate prediction of standard errors when the observed standard error for any given level of infection is known.

A method of estimating standard errors for grouped bunt data is suggested, involving the fitting of infection curves to observed standard errors. For instance, at Bozeman, Montana, a curve fitted for the range from 0 to 35 per cent. bunt in spring wheat might be expected to yield reliable estimates of standard error within this range. While somewhat

empirical, since the results are partially dependent on the size of the bunt classes, the proposed method of estimating standard errors is considered to be much more reliable than those in current use.

SCHLEHUBER (ALVA M.). **The inheritance of reaction to physiologic races of Tilletia tritici (Bjerk.) Wint. in a winter Wheat cross.**—*Res. Stud. St. Coll. Wash.*, vi, 2, pp. 75–96, 3 graphs, 1938.

Investigations [which are fully described] into the inheritance of the individual reactions in the winter wheat cross White Odessa (C.I. 4655) × Turkey-Florence (C.I. 10080) to two physiologic races of *Tilletia tritici* [*T. caries*], Ft–4 [*R.A.M.*, xvii, p. 305] and one isolated originally on Ridit wheat, and referred to as Ridit *tritici*, showed that neither the high susceptibility of White Odessa nor the high resistance of Turkey-Florence to Ft–4 was recovered in 108 families of the F_3 progeny. At least four genes controlling resistance to Ft–4, all cumulative in their effect, appear to be present. Both parents were found to be moderately susceptible to Ridit *tritici*. About 18·75 per cent. F_3 families were more resistant than White Odessa, and an equal percentage more susceptible than Turkey-Florence, to Ridit *tritici*. White Odessa appears to be of the constitution AABB and Turkey-Florence aabb, the percentage of bunted plants of the former averaging about 56, and those of the latter about 76. The F_3 families segregated in accordance with the Mendelian ratio 9 : 3 : 3 : 1. Transgressive inheritance in reaction to Ridit *tritici* was established in the F_4 progeny.

The reaction of White Odessa, Turkey-Florence, and 76 of their F_3 families to an equal mixture of Ridit *tritici* and Ft–4 showed that the average percentage of bunt in the parents produced by the mixture varied comparatively little from the percentage produced by the race to which the variety is the more susceptible. The author states, however, that in mixtures of numerous races the non-virulent races inhibit the effectiveness of the virulent races much more than if only two races are used, probably owing to the dilution of the virulent inoculum. The reaction of the F_3 families to the mixture is similar to that obtained from Ridit *tritici*. Because of the lack of correlation between infection by Ft–4 and Ridit *tritici* it is concluded that resistances to these two races are controlled by completely different genes. The high correlation between the results for Ridit *tritici* and the mixture suggests that resistance to the mixture of the two races largely depends on the factors controlling resistance to Ridit *tritici*. Since the reaction to Ft–4 involves four factors and that to Ridit *tritici* two, at least six genes must operate in the resistance to the mixture.

JONES (G. H.) & EL NASR (A. EL G. S.). **Control of four smut diseases by regulation of planting method under irrigation.**—*Nature, Lond.*, cxlii, 3603, pp. 917–918, 2 graphs, 1938.

Experiments were carried out in the Cairo district to determine the effect of different planting methods on flag smut [*Urocystis tritici*: *R.A.M.*, xvi, p. 167] and bunt of wheat [*Tilletia foetens*], covered smut of barley [*Ustilago hordei*: ibid., xiv, p. 158], and grain smut [*U. panici-miliacei*] of millet [*Panicum miliaceum*: ibid., xvii, pp. 434, 628]. When the seed was broadcast on moist soil and ploughed in (herati

method), there was two to three times more flag smut [ibid., xiv, p. 24], six times more covered smut of barley [ibid., x, p. 448], five times more wheat bunt [cf. ibid., xvii, p. 14], and also more millet grain smut than in plants from seed broadcast on dry soil, harrowed in with a wooden baulk, and irrigated (afir method). In one experiment with flag smut the herati method (sowing depth 8 cm.) gave 8·6 per cent. infection, the afir method (sowing depth 4 cm.) 3·2 per cent., and mud sowing by flooding dry soil and broadcasting the seed one hour later, 0·08 per cent., and in another experiment the herati method gave 8·1 per cent., a modification of the afir method (whereby the broadcasted seed was covered by raking instead of by harrowing, giving a sowing depth of 2·5 cm.) 2·4 per cent., and mud sowing by ploughing and flooding moist soil followed by broadcasting the seed one hour later 0·2 per cent. The progressive increase of infection at the deeper soil layers may be due to the longer susceptible stage of the seedlings, while the strikingly low incidence in the shallowest sowings is possibly attributable to the development of the coleoptiles in the air rather than in damp soil. The practical applications of these data to irrigation farming are very briefly indicated.

Allen (P. J.) & Goddard (D. R.). **A respiratory study of powdery mildew of Wheat.**—*Amer. J. Bot.*, xxv, 8, pp. 613–621, 6 graphs, 1938.

In addition to the results already published in the preliminary report of this study [*R.A.M.*, xviii, p. 14] the authors found that in a later experiment the oxygen consumption by mildewed wheat was 650 per cent. greater than normal. The respiratory rate of the first leaves of healthy wheat is high during the first few days but reaches a fairly constant level after nine days from the time of planting, whereas on inoculation with mildew (*Erysiphe graminis* var. *tritici*) the rate rises, becoming after two days twice as high as that of healthy wheat. The maximum is reached about six days after inoculation, from which day onwards the respiration of the wheat is always about 3·4 times as high as that of the mildew, this constant relation between the respiration rates of host and fungus persisting through a series of rather large subsequent fluctuations. Within temperature limits between 12° and 30° C. an increase of temperature was found to increase the rate of oxygen uptake in both healthy and mildewed wheat, respiration increasing more rapidly in the former over high than over low temperature ranges, while the opposite holds good for the latter. The results show that infection of wheat with *E. graminis* causes an increase in the rate of respiration of the mesophyll tissues roughly proportional to the degrees of infection. It is suggested that a diffusible substance is produced by the mildew, or possibly by the epidermal cells, which passes out into the mesophyll and brings about an increase, more or less permanent, in the rate of respiration.

Garrett (S. D.). **Soil conditions and the take-all disease of Wheat. III. Decomposition of the resting mycelium of Ophiobolus graminis in infected Wheat stubble buried in the soil.**—*Ann. appl. Biol.*, xxv, 4, pp. 742–766, 1 pl., 12 graphs, 1938.

In continuation of the author's study on the take-all disease of wheat

(*Ophiobolus graminis*) [*R.A.M.*, xvii, pp. 230, 592], pieces of artificially infected wheat straw were buried in variously treated soils contained in glass tumblers, and were examined at fortnightly intervals over a period of 18 weeks for the presence of viable resting mycelium by means of a wheat seedling test. The results suggest that decline in the viability of the resting mycelium in infected wheat straw is due to its natural decomposition by other soil micro-organisms, since it was possible to correlate the decline with the microbiological activity of the soil throughout the experiments. The viability of the resting mycelium persisted apparently undiminished in dry air, sand, air-dry soil, in soil at 2° to 3° C., and under sterile conditions in the culture flask. The decline of viability was less rapid in a waterlogged soil than in one maintained at a medium moisture content; it was accelerated by the addition of energy materials containing little or no nitrogen, such as glucose, starch, and rye grass meal, to the soil; it was more rapid in a partially sterilized and reinoculated soil than in an untreated one. The rate of decline varied with the type of the soil, being more rapid in rich and heavy soils than in poor, light ones; it was apparently not directly affected by soil reaction, nor appreciably by moisture content of the soil over the range 30 to 80 per cent. saturation, and was more rapid under conditions of fluctuating soil moisture and improved aeration in unglazed pots than under more uniform conditions in glass tumblers; decline was slowest in a small closed incubator. Thus, the most rapid disappearance of the resting mycelium of *O. graminis* was observed under conditions favouring a rise in number and activity of soil micro-organisms. The decline in viability of the resting mycelium did not necessarily proceed parallel with the decomposition of the straw as a whole; it was delayed by the addition to the soil of dried blood containing 13 per cent. nitrogen, which accelerated the decomposition of the straw, and was expedited by the addition of rye grass meal, which delayed decomposition of the straw by taking up the available nitrogen. It is suggested that the mycelium itself may serve as a source of nitrogen for the decomposition of the straw and that the addition of substances rich in nitrogen protect it from the nitrogen demands of the organism engaged in decomposing the straw.

LEUKEL (R. W.), STANTON (T. R.), & STEVENS (H.). **Comparison of different methods of inoculating Oat seed with Smut.**—*J. Amer. Soc. Agron.*, xxx, 10, pp. 878–882, 1938.

The results of studies at the Idaho Agricultural Experiment Station on the relative merits of different methods of inoculating oats with loose and covered smuts (*Ustilago avenae* and *U. levis* [*U. kolleri*: *R.A.M.*, xvi, p. 807]), using the moderately susceptible Iogold, extremely susceptible Victory, and resistant Markton varieties (the last-named in one test only), showed that the immersion of the seed in a spore suspension under vacuum may give as high infection percentages as those arising from hulling the seed and dusting it with spores. Inoculation by the latter method may cause a severe reduction in emergence and stand, even in resistant varieties, besides being extremely laborious. The suspension-vacuum method offers a quick and

effective means of inoculating large numbers of oat seeds with the two smuts under observation.

HUTCHINS (H. L.) & LUTMAN (B. F.). **Spine development on the spores of Ustilago zeae.**—*Phytopathology*, xxviii, 11, pp. 859–860, 1 fig., 1938.

A brief account is given of the process of spine development from a gelatinous matrix on the spores of *Ustilago zeae*, in the accurate observation of which an adaptation of W. G. Hutchinson's stain combination of orseillin BB with aniline blue was found extremely effective. The spines emerged as minute, acuminate, knob-shaped, or conical structures, gradually changing from vivid red to grey and finally brown, from the blue-stained jelly of the rudimentary spore walls, the alteration in colour being associated with the impregnation of the protuberances with chemicals other than cellulose or lignin. The jelly surrounding the spines appeared to collapse and disappear in the later stages.

KOEHLER (B.) & WOODWORTH (C. M.). **Corn-seedling virescence caused by Aspergillus flavus and A. tamarii.**—*Phytopathology*, xxviii, 11, pp. 811–823, 3 figs., 1938.

Virescence of maize seedlings, indistinguishable from that heretofore attributed exclusively to genetic factors, was induced at the Illinois Agricultural Experiment Station by inoculation of the seed with *Aspergillus flavus* or *A. tamarii* [*R.A.M.*, xiv, p. 355]. The chlorophyll deficiency associated with both the hereditary and acquired forms of the disorder is aggravated by insufficient light (daylight only as opposed to continuous illumination), low soil temperatures (16° to 18° compared with 30° C.), and a relatively high soil moisture content (27 as against 18 per cent.); the development of virescence was further shown to be generally promoted by storage of the soils for three months or more without cropping prior to experimental use. Under appropriate conditions a high proportion of the open-pollinated maize varieties of the dent, sweet, pop, flint, and flour types tested developed induced virescence, and, with a few exceptions, the inbred lines were also susceptible. The rupture or partial removal of the seed coat was necessary to ensure effective inoculation; good results were obtained by shaving off the seed coat from the crowns of the kernels before shelling the ear. Ten isolations of *A. flavus* and two of *A. tamarii* from various sources were all instrumental, though not of equal potency, in causing virescence, which did not result, however, from infection by a number of other species. In simultaneous inoculation tests the admixture with *A. flavus* suspensions of 10^7 spores per c.c. of an equal spore volume of *A. niger*, *Penicillium viridicatum*, *P. notatum*, *P. expansum*, or *Fusarium moniliforme* [*Gibberella fujikuroi*] substantially reduced the extent of virescence caused by the first-named.

MCNEW (G. L.). **The relation of nitrogen nutrition to virulence in Phytomonas stewarti.**—*Phytopathology*, xxviii, 11, pp. 769–787, 2 figs., 1 graph, 1938.

Ten strains of *Phytomonas* [*Aplanobacter*] *stewarti* differing in virulence towards Golden Bantam maize seedlings [*R.A.M.*, xvii, pp. 740,

810] were found to possess the following identical characters. All consisted of small, Gram-negative, non-motile, asporogenous rods. None produced indol from tryptophane or gas from carbohydrates. All caused similar changes in the acidity of media containing different carbohydrates and gave rise to the same type of growth on potato slants. The differences noticed were as follows. Two slightly virulent strains failed to utilize nitrogen from inorganic sources, two others formed small, firm, yellow colonies on nutrient dextrose agar poured plates, and the most strongly pathogenic reduced nitrates to nitrites and produced a curd in litmus milk.

The ability to utilize inorganic nitrogen was experimentally shown to be invariably correlated with virulence. Growth on a synthetic agar medium containing no organic nitrogen increased the pathogenicity of slightly virulent cultures, presumably by a course of continuous intensive selection of variants. By repeated selection of the most virulent variants occurring in dilution plates from cultures on nutrient agar it was possible to derive a virulent culture from a mildly pathogenic strain by a process analogous to that occurring in the host.

Most of the virulent strains utilized ammonium nitrogen much more readily than nitrate nitrogen. The most severely pathogenic (B–Gl) of all those tested reduced nitrates to nitrites in a medium containing both ammonium and nitrate nitrogen. This and other virulent strains produced nitrites in badly wilted plants, but the nitrites were shown not to be the sole cause of the symptoms.

WANG (C. S.). **The formation of chlamydospores of Ustilago crameri Kcke. on artificial media.**—*Phytopathology*, xxviii, 11, pp. 860–861, 1938.

In monochlamydospore cultures of *Ustilago crameri* [the agent of kernel smut of millet (*Setaria italica*) in China: *R.A.M.*, xvi, pp. 247, 741], grown on 1, 2, or 3 per cent. potato dextrose or malt agar for ten weeks at room temperature, numerous intercalary chlamydospores were produced, mostly from hyphal strands but occasionally by mycelial fragmentation into short segments. Most of the hyphal cells were binucleate, but uninucleate ones were not uncommon and a few multinucleate individuals were observed. The fusion of two nuclei into one was mostly detected during the process of gelatinization of the enlarging mycelial cells which constitutes the first step in chlamydospore formation. The chlamydospores produced in this manner correspond in dimensions and structure with those developing naturally on the host and germinate normally.

MCDONOUGH (E. S.). **Host-parasite relations of Sclerospora graminicola on species of Setaria.**—*Phytopathology*, xxviii, 11, pp. 846–852, 2 figs., 1938.

In this expanded account of the writer's studies on the mode of infection of *Setaria italica* and *S. viridis* by *Sclerospora graminicola*, a preliminary note on which has already appeared [*R.A.M.*, xvi, p. 527], it is stated that infected seedlings were found with the coleorrhiza just emerging and the natural entrance of the fungus is thought to occur

most often through this organ. The fungus was observed to have become systemic before the mesocotyl had elongated appreciably.

GHATAK (P. N.). **Investigations on Orange rot in storage. I. Orange rot due to two strains of Fusarium moniliforme Sheldon.**—*J. Indian bot. Soc.*, xvii, 2–3, pp. 141–148, 1 pl., 4 figs., 1938.

Kamala oranges (*Citrus chrysocarpa*) sold in Calcutta markets during winter are affected by a soft rot caused by two strains of *Fusarium moniliforme* [*Gibberella fujikuroi*: *R.A.M.*, xvi, p. 656], one referred to as A1 being obtained from fruits from Darjeeling and the other, A2, from fruits from Assam. A small, semi-pliable, light brown, water-soaked area appears on the rind, subsequently enlarging and showing white patches in the centre bearing conidia; finally, the whole surface of the fruit becomes covered with a white encrustation and the orange is reduced to a pulpy mass. Oranges from Darjeeling and Assam are more liable to this condition than those from Nagpur, which are only very slightly affected. The two strains (distinguished chiefly because of differences in pathogenicity) have similar morphological characters, but mycelial growth is more vigorous in A1 than in A2. Inoculation tests showed both strains to be wound parasites. Strain A1 readily infected Assam and Darjeeling oranges and in some cases Nagpur oranges, whereas A2 infected only Assam oranges vigorously, was less virulent on Darjeeling, and was almost unable to infect Nagpur fruits.

ULLSTRUP (A. J.). **Variability of Glomerella gossypii.**—*Phytopathology*, xxviii, 11, pp. 787–798, 4 figs., 1938.

Variations in the cultural characters of *Glomerella gossypii* on potato-dextrose agar were observed on initial isolation from diseased cotton tissues [*R.A.M.*, xvii, p. 392] from South Carolina, Virginia, and Georgia, suggesting the occurrence of such variant types in nature. During the course of the investigations all the cultures gave rise to at least one variant. The majority of the aberrant forms fell into two fairly well-marked classes on the basis of their growth habits, the larger characterized by a dense, white, cottony aerial mycelium and the other consisting of cultures forming sparse, buff-coloured colonies. All but one of the original cultures were highly pathogenic to cotton seedlings, whereas some of the variants were only slightly virulent. A low degree of virulence was found to be directly correlated with a slow growth rate of the culture. Cytological observations disclosed a uninucleate condition of the conidia and hyphal cells, which, in conjunction with the characteristic type of variation, indicates that the changes in cultural reactions and pathogenicity are probably due to mutation in the heritable nuclear material. From a practical point of view such modifications appear to be of little importance.

ROGERS (C. H.). **Growth of Phymatotrichum omnivorum in solutions with varying amounts of certain mineral elements.**—*Amer. J. Bot.*, xxv, 8, pp. 621–624, 1938.

Following preliminary field experiments, begun in Texas in 1934, on the reaction of *Phymatotrichum omnivorum* [*R.A.M.*, xviii, p. 24] to certain mineral elements, the fungus was grown in the laboratory in

synthetic culture solutions containing starch and sucrose to which were added the elements in concentrations of from 0·2 to 500 p.p.m., and the dry weights of the mycelium were determined, after 15 to 30 days' growth. The initial growth of *P. omnivorum* in flasks containing copper (as cupric sulphate) at 5, 10, and 25 p.p.m., and in those containing 50 p.p.m. of iron (ferrous sulphate) and mercury (mercuric chloride) was very slow but became more rapid as the growth period extended. In another set of experiments the growth of the fungus was inhibited at concentrations of copper above 10 p.p.m. After 15 days there was a perceptible stimulation in the growth of the fungus in flasks containing low concentrations (1 p.p.m.) of copper, iron, manganese (manganese sulphate), and all concentrations of zinc (zinc sulphate) tested up to and including 200 p.p.m.; after 30 days there was stimulation of growth from all concentrations of manganese from 1 up to 500 p.p.m. and from aluminium (aluminium sulphate) at 10 and 50 p.p.m. In the higher concentrations of iron, both fungus and medium assumed an iron-grey colour during the later stages of growth, and in the highest concentrations of boron at which the fungus grew (200 p.p.m.), the cells of individual hyphae were distorted. At concentrations of manganese of 200 to 500 p.p.m. the mycelium spread over the entire surface of the medium and later broke up into a number of very compact and dense mats, which at 200 p.p.m. reunited again or at 500 p.p.m. remained distinct, few or no sclerotia being produced. The addition of starch to a medium resulted in ten times more growth of the fungus than in a non-starchy medium. No growth was obtained after three weeks in a non-starchy medium containing concentrations of copper at and above 1 p.p.m. It is evident from the results of these experiments that copper in the form of cupric sulphate was the most toxic of the elements tested, mercury as mercuric chloride coming second.

KESTEVEN (H. L.). **Dermatitis eutorulosa, with a description of the causative fungus.**—*Med. J. Aust.*, N.S., i, 23, pp. 963–967, 4 figs., 1938.

A diagnosis [in English only] is given of *Eutorula excorians* n.sp., which has been definitely shown by the results of carefully controlled pathogenicity tests, fulfilling Koch's postulates, to be the agent in Australia of a localized papulo-vesicular dermatitis with or without excoriation and weeping inflammation, 13 cases of which (all in adults) are briefly described.

The thin-walled cells average 8 to 10 μ in diameter, with a range from 2 to 12 μ. A careful search failed to reveal any trace of spore formation. Simple binary fission is usually effected by the budding-off of a cell 2 μ in diameter, but equatorial and equal division is not uncommon, and the intermediate stages of subequal fission may also be observed. The organism grows freely on Sabouraud's glucose and maltose peptone agars and other media, forming nearly circular, smooth, shining, pure white colonies, reminiscent of the polished surface of ivory; faint radial and concentric striations may be present. The cultures emit a slight odour suggestive of fermenting hops. Dextrin was rapidly fermented, followed by glucose, mannite, and sucrose. Gelatine was slowly liquefied. *E. excorians* differs from the nearly related *E. bernasconi* Fontoy-

nont and Boucher (*Ann. Derm. Syph., Paris*, xi, p. 318, 1923) in the paucity of piriform cells, absence of short filaments, and delicate membrane.

STEVENIN (G.). **Étude sur les teignes animales.** [A study of animal ringworms.]—Thèse Ec. nat. vét. Alfort, 140 pp., 1938.

This is a very comprehensive and fully documented survey of the etiology, symptomatology, and therapy of animal ringworms of fungal origin, the term 'animal' being here understood as covering those species of *Trichophyton*, *Microsporon*, and other genera which primarily attack live-stock but are readily transmissible to man [cf. *R.A.M.*, xvii, p. 175 *et passim*].

CATANEI (A.). **L'allergie teigneuse chez le Cobaye et les variations des leucocytes dans la teigne expérimentale.** [Ringworm allergy in the Guinea-pig and the variations of the leucocytes in experimental ringworm.]—*Arch. Inst. Pasteur Algér.*, xvi, 1, pp. 21–25, 1938.

Details are given of the variations in the numbers of leucocytes counted in the blood of guinea-pigs during the allergic period following experimental inoculation and reinoculation with *Ctenomyces mentagrophytes* (*Trichophyton asteroides*) [*T. mentagrophytes*: *R.A.M.*, xvii, pp. 38, 746, 818]. Polynucleosis generally begins on the fifth to the eighth day and may persist up to the fourth week after the original inoculation, reaching a maximum during the third. The increase in the leucocyte count rarely falls below 10 per cent., usually ranging from 10 to 20 or 20 to 30 (33 in one instance). Reinoculation after periods ranging from a fortnight to two months resulted in a rapid increase of leucocytes from the second day onwards, followed by a decrease, usually abrupt, to normal.

CATANEI (A.). **La flore parasitaire des mycoses de l'homme en Algérie.** [The parasitic flora of human mycoses in Algeria.]—*Arch. Inst. Pasteur Algér.*, xvi, 1, pp. 18–20, 1938.

The three main types of ringworm, trichophytosis, favus, and microsporosis, are stated to be very variably distributed in Algeria according to ethnological and geographical factors. *Trichophyton glabrum* and *T. violaceum* [*R.A.M.*, xviii, p. 110] are the chief agents of infection among the Mohammedan natives and Jewish children. European children are also liable to attack especially by these two species, but may contract ringworm from a number of other sources as well. In addition to *T. glabrum* and *T. violaceum*, the following species occur (in order of frequency): *T. acuminatum* [ibid., xvii, p. 680], *T. crateriforme* (common in Spanish and Italian settlements, respectively), *T. fumatum* [ibid., xvi, p. 317], *T. soudanense*, and *T. pervesi* [ibid., xvi, p. 746]. The following have each been recorded once: *T. regulare* [ibid., xvi, p. 458], *T. cerebriforme*, *T. sulphureum* [ibid., xiv, p. 102], *T. plicatile* [ibid., xviii, p. 27], *T. polygonum*, and *T. umbilicatum* [ibid., xvi, p. 317]. Favus appears to be exclusively associated with *Achorion schoenleini*. *Microsporon audouini* has been detected only twice (once in a subject contaminated in France) [ibid., xvii, p. 680]. *M. felineum* is encountered sporadically, and *M.* [*Achorion*] *quinckeanum* [ibid., xvii, p. 598] has

twice been isolated from ringworm cases. Kerions of the scalp have yielded *Ctenomyces* [*T.*] *mentagrophytes* and *T. luxurians*.

The following organisms have been isolated from the 18 cases of mycetoma examined since the first observation of the disease in Algeria in 1892: *Nocardia* [*Actinomyces*] *madurae* (12 times), *Scedosporium apiospermum* [ibid., xv, p. 20] (twice), *Madurella mycetomi* [ibid., xv, p. 804] (once), *Glenospora clapieri* [ibid., vi, p. 727] (once), *Acremonium* [or *Cephalosporium*] *potroni* [ibid., xvii, p. 179] (once), and *Allescheria boydii* [cf. ibid., xiii, p. 512] (once).

Cutaneous blastomycosis of the forearm, due to *Cryptococcus* [*Candida*] *montpellieri* [ibid., xiv, p. 168], has been observed once. A typical case of thrush yielded *Monilia* [*C.*] *albicans*, and a case of glossitis ('hairy and granular tongue') was caused by *M.* [*C.*] *paratropicalis*. Sporotrichosis due to *Rhinocladium* [*Sporotrichum*] *beurmanni* [ibid., xvii, pp. 112, 242] occurred twice. Verrucose dermatitis (*Hormodendrum algeriensis*) [*H. pedrosoi*: ibid., xvii, p. 747] and inguinal tumours caused by *Blastodendrion* (*Enantiothamnus*) *braulti* [ibid., xiv, p. 383: cf. ibid., xviii, p. 27] have also been recorded.

MEMMESHEIMER (A. M.). **Über einen neuen Nährboden fur Pilzkulturen.** [On a new nutrient medium for fungus cultures.]—*Klin. Wschr.*, xvii, 2, pp. 56–57, 1938.

A medium consisting of 1,000 c.c. of filtrate of 75 to 80 gm. guinea-pig skin boiled for 30 to 45 minutes in 20 c.c. 30 per cent. potash lye and 75 c.c. tap water, 40 gm. maltose, and 18 gm. agar is stated to have proved extremely valuable for the culture of *Epidermophyton* Kaufmann-Wolf, *E.* [*Trichophyton*] *rubrum*, *Microsporon audouini*, *M. felineum*, *Achorion schoenleini*, *A. quinckeanum*, *T. gypseum*, and *T. rosaceum*. Directions are given for the preparation of a dried powder from the filtrate which may be stored and used from time to time as required.

CAROL (W. L. L.), CREMER (G.), VAN HAREN (H. B.), & BLOEMEN (J. J.). **Ein Fall von Mycotorulosis generalisata.** [A case of generalized mycotorulosis.]—*Arch. Derm. Syph., Berl.*, clxxviii, 2, pp. 177–187, 6 figs., 1938.

Full clinical details are given of a case of chronic generalized mycotorulosis in a 17-year-old girl in Holland. Pure cultures on Sabouraud's agar from the diseased tissues yielded a fungus identified at the Centraalbureau voor Schimmelcultures as *Mycotorula* [*Candida*] *albicans*, [*R.A.M.*, xviii, p. 27], the taxonomy of which, in relation to *Candida* and other allied genera, is discussed at some length. The organism is considered to be definitely implicated as the agent of the disorder, which corresponded in practically all particulars with Kyrle's disease as described by Bloch in *Iconogr. derm. syph. urol., Kyoto*, i, 1932.

ABERASTURY (M.). **Onicomicosis generalizada.** [Generalized onychomycosis.]—*Sem. méd., B. Aires*, xlv, 2317, pp. 1316–1318, 2 figs., 1938.

Fungal pathogens of the nails in the Argentine include various species of *Epidermophyton* and *Trichophyton* and yeasts, chiefly *Monilia* [*Candida*] *albicans* [see preceding abstract], a generalized case of which,

involving the fingers and toes of a 21-year-old woman, is described, chiefly from the standpoint of clinical manifestations and therapy.

Berberian (D. A.). **Mycologic technic for the study of anascosporous yeast-like fungi.**—*Arch. Derm. Syph., Chicago*, xxxviii, 4, pp. 526–534, 3 figs., 1938.

The technique employed by the writer at Beirut, Syria, for the study of anascosporous, filamenting, yeast-like fungi associated with human disease, e.g., *Monilia* [*Candida*] *albicans*, is described.

Whalen (E. J.). **Fungous infections of the external ear.**—*J. Amer. med. Ass.*, cxi, 6, pp. 502–504, 1938.

The relative frequency of the pathogenic fungi associated with otomycosis varies in different parts of the world, *Aspergillus* predominating in China [*R.A.M.*, xiv, p. 633] and in the temperate zone of the Americas, while *Monilia* [*Candida*] is more prevalent in the Canal Zone. Other genera represented in infections of the aural canal include *Penicillium*, *Achorion*, and *Mucor*. The present paper deals chiefly with the therapeutic treatment of the disorder.

Stewart (R. A.) & Meyer (K. F.). **Studies in the metabolism of Coccidioides immitis (Stiles).**—*J. infect. Dis.*, lxiii, 2, pp. 196–205, 2 graphs, 1938.

A detailed, tabulated account is given of the writers' studies on the metabolism of *Coccidioides immitis* [*R.A.M.*, xviii, p. 29] which was shown to present no significant differences in either a protein-rich (veal infusion broth) or synthetic medium. Contrary to statements in the relevant literature, glucose was assimilated both by *C. immitis* and *Blastomyces* [*Endomyces*] *dermatitidis* [loc. cit.] on synthetic media. The resistance of *C. immitis* to desiccation may be an important factor in the dissemination of the organism in the dry, warm climate of the San Joaquin Valley, California [see next abstracts], where environmental conditions favour the development of the chlamydospores which are apparently essential for animal infection.

Dickson (E. C.). **Coccidioidomycosis: the preliminary acute infection with fungus Coccidioides.**—*J. Amer. med. Ass.*, cxi, 15, pp. 1362–1365, 1938.

Further clinical details are given of the preliminary acute phase of infection by *Coccidioides* [*immitis*: see preceding abstract] in man and animals in the San Joaquin Valley of California [*R.A.M.*, xvii, p. 112], which can now be definitely attributed to the inhalation of chlamydospores with dust. Erythema nodosum is a very frequent, but not a constant, concomitant of this early stage of coccidioidomycosis, recovery from which is usual, though the subsequent development of the semichronic granulomatous form of the disease, with a mortality rate of 50 per cent., is by no means excluded.

Dickson (E. C.) & Gifford (M. A.). **Coccidioides infection (coccidioidomycosis). II. The primary type of infection.**—*Arch. intern. Med.*, lxii, 5, pp. 853–871, 6 figs., 1 graph, 1938.

This is a comprehensive discussion, supplemented by eight case reports, of the clinical aspects of the primary type of infection by

Coccidioides immitis [see preceding abstracts], of which a total of 354 cases (139 males and 215 females) was reported in the San Joaquin Valley, California, during the period from 1st January, 1936 to 15th May, 1937. The term 'coccidioidomycosis' is suggested to include all types and phases of the disease, individual cases being classified as due to primary coccidioidomycosis and progressive (secondary) or granulomatous coccidioidomycosis.

MÜLHENS (K. J.). **Beobachtungen an drei Cephalosporienstämmen, die aus menschlichem Blut und Harn gezüchtet wurden.** [Observations on three strains of *Cephalosporium* cultured from human blood and urine.]—*Zbl. Bakt.*, Abt. 1 (Orig.), cxlii, 3–4, pp. 160–165, 2 figs., 1938.

Three strains of *Cephalosporium* were isolated from the blood and urine of a girl suffering from septicaemia at the Bonn (Germany) Children's Hospital [*R.A.M.*, xv, pp. 219, 501]. Although the results of inoculation experiments on guinea-pigs, mice, and a human subject did not denote virulent pathogenicity on the part of the strains, the fungus is thought to be probably more important as a source of embolic contamination than is generally supposed.

KNOWLES (N. R.) & CLERKIN (P.). **Investigation of an instance of mould infection in sealed eggs.**—*J. Minist. Agric. N. Ire.*, vi, pp. 63–68, 1938.

Eggs preserved at a factory in Northern Ireland, though outwardly normal, developed an average spoilage of 12½ per cent. (the loss in some instances reaching 60 per cent.) as a result of mould growth [cf. *R.A.M.*, xvii, p. 794] in the air-space and less often on the shell in the white. The air-space moulds were all due to species of *Penicillium*, while the others, enclosed in gelatinous knobs, were due to *Sporotrichum*, many strains being identified as *S. carnis* [ibid., xiii, p. 442]. Eggs infected with either type of mould had a musty flavour. Infection was also accompanied by a high proportion of sour and black-rotted eggs, these conditions resulting from bacterial invasion.

It was considered that entry was in all probability due to two factors in processing, viz., (*a*) alternate warming and cooling, which resulted in expansion and contraction of the air-space, and (*b*) more probably the forcing-in of organisms on the surface of the eggs by the entrance of wax through the pores during sealing under reduced pressure. Contamination appeared to have occurred in the factory, before or during pre-heating.

Inspection of the buildings revealed the presence of dampness, the existence of dusty lofts with damp patches over the testing and pre-warming rooms, and dilapidations. The number of mould (*P.* spp.) spores falling per hour per sq. ft. in the different rooms ranged from 35 to 168. The control recommendations made were as follows. All walls and ceilings were to be disinfected and lined with tin, iron, or cement. The ventilation of every room was to be made directly to the outside air, the ventilators projecting several feet above roof-level, and the air required during drying to be drawn from outside. All wooden beams, pillars, and rafters were to be enclosed in sheet iron or cement. The insulating material (cork chips) above the pre-heating room was to be

removed, and after each of these operations all the rooms were to be thoroughly disinfected. Further, at equal intervals, and before sealing the eggs, all the rooms were to be fumigated by the Maine process, using 1 part potassium permanganate and 2 parts formalin (40 per cent.). In addition, all floor surfaces were washed daily with formalin solution. After these measures had been in force for rather less than six months, infection by *Penicillium* was reduced to approximately 1 per cent.

BOSE (R. D.) & MISRA (S. D.). **Studies in Indian fibre plants, No. 6. Phyllody and some other abnormalities in the flower of Sunn-Hemp.** —*Indian J. agric. Sci.*, viii, 4, pp. 417–423, 2 pl., 1938.

A description is given of twelve types of phyllody observed in from 0·05 to 6·61 per cent. of seven strains of sunn-hemp (*Crotalaria juncea*) at Pusa, involving the transformation of some or all the floral whorls into greenish leaf-like structures and causing complete sterility of the plant. Other abnormalities associated with the phylloid condition include proliferation of parts, adherence of vegetative shoots formed by the converted stamen and carpel, and fasciation. Transmission of the disorder was successfully accomplished in five weeks in 14 out of 20 grafted plants (normal scions on phylloid stocks and reciprocally), the plants being covered with muslin bags. The remaining 6 grafts were damaged. These results are considered to suggest the implication of a virus in the etiology of the disease [cf. *R.A.M.*, xvii, p. 555].

[The occurrence of a similar disturbance in *C. striata* [*C. saltiana*] at Bombay is described by R. E. Cooper in *J. Univ. Bombay*, vi, 5, pp. 57–61, 1 pl., 1 fig., 1938.]

DORAN (W. [L.]). **Germination of seeds and damping-off and growth of seedlings of ornamental plants as affected by soil treatment.**—*Bull. Mass. agric. Exp. Sta.* 351, 44 pp., 2 figs., 1938.

In search of safe and inexpensive soil fungicides for the control of the post-emergence damping-off of seedlings, caused by *Rhizoctonia solani* and two species of *Pythium* [unspecified], the author conducted a series of trials [some of the results of which have already been noted from other sources: *R.A.M.*, xvi, p. 659; xvii, p. 502] with seeds or cuttings from 112 different species of ornamental plants and vegetables [listed in the appendix], grown in artificially infected autoclaved soil or in naturally infected soil. In the light of the author's own and other workers' investigations damping-off appears not to be controllable by the adjustment of soil temperature, moisture, and reaction, the environmental conditions favourable to plants being also propitious to fungi. Generally a soil treatment, favourable to some plants, was not so good or even injurious for others; thus charcoal, which is not considered to be a fungicide, significantly improved the growth of nasturtium (*Tropaeolum majus*), but had no such effect on *Aubrietia*, heliotrope (*Heliotropium peruvianum*), or sweet pea, while calcium sulphate favourably affected sweet pea only. Damping-off was not controlled by calcium sulphate, acetate, or chloride, or by raising the hydrogen-ion concentrations of soil with hydrated lime, but it was satisfactorily combated by calcium cyanamide and ammonium hydroxide, which latter did not injure the germination of most species, while ammonium acetate was less effective.

The interval between soil treatment and seeding depends to some extent on the strength of the toxic effect of the fungicide on the plant, and partly on the species of plant involved; in general, formic acid, formaldehyde, acetic acid (and vinegar) were less injurious to slowly germinating seeds than to those which germinated rapidly; there is a considerable delay between soil treatment and seeding in the case of calcium cyanamide. Tannic acid improved the growth of foxglove (*Digitalis purpurea*) and apparently improved the soil physically, but did not seem to exert a fungicidal effect. Less than one-fifth as much formaldehyde as was formerly used controlled damping-off when less water was applied with it. Acetic acid dusts controlled damping-off and were not injurious to most species of plants when applied to the soil the day before seeding, but were toxic to softwood cuttings.

Quantities of volatile chemicals which were not injurious when applied to the soil immediately before sowing were harmful when strewn over the surface of the soil immediately after. Acetic acid and formaldehyde injured crucifers more often than other plants. Vinegar in amounts too small to control damping-off was injurious when applied after the emergence of seedlings. Acetaldehyde was less harmful to both plants and fungi than formaldehyde and improved the growth of sweet pea, as did also ethyl alcohol. Calcium hypochlorite [ibid., xiv, p. 673] cannot be safely used in effective quantities with most species immediately before sowing, and the interval between soil treatment and sowing must be adequately prolonged. Seeds of a plant requiring three months to germinate were not well protected by acetic acid, but were by copper oxalate, indicating that seeds and seedlings of slowly germinating species of plants may be better protected by inorganic salts than by volatile chemicals. All salts of copper were injurious to many plants, hollyhock (*Althaea rosea*) showing the greatest tolerance. Species of *Dianthus* and *Rhododendron* were notably tolerant of sulphuric acid, and the former also of aluminium sulphate in quantities injurious to many other plants. No control was obtained with potassium permanganate or flowers of sulphur.

AINSWORTH (G. C.). **A note on certain viruses of the Cucumber virus 1 type isolated from monocotyledonous plants.**—*Ann. appl. Biol.*, xxv, 4, pp. 867–869, 4 figs., 1938.

The results of inoculations of tobacco and cucumber plants with virus strains isolated from mosaic-diseased lily, hyacinth, and tulip plants proved that these strains were related to cucumber virus 1 [*R.A.M.*, xvii, p. 585], the only difference being their tendency to remain localized in tobacco and cucumber, while cucumber virus 1 and most of its variants become systemic in these hosts. The tulip strain showed a similarity to strain 6, described by Price [ibid., xiv, p. 812], and a greater intensity of necrotic action than the lily or the hyacinth strains, the two latter being more similar to each other than to the tulip strain.

OBEE (D. J.). **Studies on the host range of Sclerotium delphinii Welch.**—*Trans. Kans. Acad. Sci.*, xl, pp. 89–93, 1 pl., 1938.

A list is given of 106 plants which were inoculated by the writer with *Sclerotium delphinii* [*R.A.M.*, xvii, pp. 557, 763, and above, p. 153]

from *Ajuga reptans*, mycelium from potato dextrose agar cultures being introduced into the soil round the roots of potted plants in the greenhouse. Among the 77 infected and subsequently killed by the fungus were hollyhock, *Anchusa capensis*, *Aquilegia canadensis*, begonia, *Calceolaria*, *Campanula persicifolia*, wallflower, *Chrysanthemum maximum*, dahlia, *Digitalis purpurea*, *Gypsophila* spp., *Impatiens balsamina*, *Lavendula spica*, lupins, *Narcissus tazetta*, poppies (*Papaver orientale* and *P. nudicaule*), *Petunia hybrida*, *Primula*, *Portulaca grandiflora*, *Rosmarinus officinalis*, *Viola* spp., *Ricinus communis*, potato, tomato, celery, and cauliflower. It is apparent from these data that the potential host range of *S. delphinii* is almost as wide as that of the closely related *S. rolfsii* [ibid., xvii, p. 750]. The symptoms caused by both fungi are practically identical.

Buddin (W.). **Root rot, shoot rot, and shanking of Tulip caused by Phytophthora cryptogea Pethybr. & Laff. and P. erythroseptica Pethybr.**—*Ann. appl. Biol.*, xxv, 4, pp. 705–729, 8 figs., 1938.

Phytophthora cryptogea and *P. erythroseptica* have been isolated from numerous specimens of forced tulips from nurseries in Hampshire, Middlesex, Lancashire, Scotland, and other parts of Great Britain, suffering from a serious disease, formerly known under the name of 'shanking' [*R.A.M.*, xvi, p. 615], though rotting of the root and shoot are also characteristic symptoms. The disease may cause great losses, houses containing 30,000 forced bulbs not infrequently failing to produce a single flower. It was first recorded in 1928 [ibid., ix, p. 594] and has not yet been reported elsewhere, though it appears to be widely distributed in Great Britain.

Repeated reisolations, a comparison of the isolates in pure culture with authentic strains, and comparative inoculation and soil contamination experiments proved the two species to be, either separately or in conjunction, the cause of the disease. Soil contamination experiments with *P. cryptogea* var. *richardiae* and *P. parasitica* gave negative results. The infection spreads from contaminated soil into the roots, which begin to be attacked as soon as the first roots are produced, and then passes through the basal plate of the bulb to the base of the flowering stem, practically without affecting the old bulb scales. The infected bulbs produce either no shoots at all, or shoots bearing blind flower buds owing to the flower stems being rotted at the base, or they may produce a flower of very poor quality. A very similar disease was induced in outdoor tulips by inoculation of the soil with either fungus, and it is thought that the disease may have been overlooked out of doors because the symptoms are less severe and liable to be confused with those of plants suffering from basal plate damage, injuries from careless hoeing, or from attacks of mice or slugs. The disease is believed to be mainly carried in contaminated soil, a contaminated water-supply being a possible but relatively unimportant factor, while there is no evidence that it is transmitted with the bulb, the spread of infection from one or more inoculated bulbs planted in the midst of healthy ones in the glasshouse being comparatively slow. Of the tulip varieties used in this study, William Pitt and William Copland of the Darwin type are highly susceptible, Rose Copland and Bartigon are freely attacked,

Pride of Haarlem and Madam Krelage less so, and Clara Butt is relatively resistant. Out of doors Inglescombe Yellow was very resistant. The disease has been seen in Vermilion Brilliant, White Swan, and White Hawk, and the double early variety Tea Rose is also susceptible. Steam-sterilized soil yielded 99·5 per cent. of marketable blooms, whereas the untreated contaminated soil yielded only 30 per cent.; soil treated with formaldehyde (1 part of a 38 to 40 per cent. solution to 49 of water) at least a fortnight before planting gave an average of 97 per cent. of good blooms against 30 per cent. on the untreated soil. Soil treatment with Cheshunt compound gave unsatisfactory results.

WILLIAMS (P. H.). **Investigations on the rust of Roses, Phragmidium mucronatum Fr.**—*Ann. appl. Biol.*, xxv, 4, pp. 730–741, 1938.

In this study on rose rust (*Phragmidium mucronatum*) [*R.A.M.*, xvii, p. 682] the author gives the results of investigations started at Cheshunt in 1933, progress reports on which have already been noticed from other sources [ibid., xvi, p. 726]. On the basis of inoculation tests on the rose, *Rosa laxa*, Kokulensky's *canina*, Deegen's *canina*, Schmidt's Special, and *R. canina*, the author classifies the strains of the rust into five groups: (1) strains A and E, both from *R. canina*, infecting all the test hosts except Kokulensky's *canina* and rose (subinfection with E), and in the case of A, Schmidt's Special; (2) B, H, and K from *R. laxa*, Kokulensky's *canina*, and Deegen's *canina*, respectively, infecting all hosts except rose, which showed lesions but no spots; (3) F from *R. laxa*, infecting all except Kokulensky's *canina* and Schmidt's Special; (4) C and G from rose, infecting only the rose and Schmidt's Special, and (5) D from *R. rugosa*, infecting rose but not *R. laxa*, the only hosts tested. From these results the author concludes that cross-infection between briars of the *R. canina* and *R. laxa* groups and the cultivated roses does not take place to any extent. The strains from *R. laxa* and *R. canina* were found to resemble each other closely in the size of the teleutospores, while the average size of those from the cultivated rose strains was somewhat larger. The teleutospores of *P. mucronatum* require a period of rest and exposure to winter conditions for proper ripening and germination. The mycelium is capable of persisting for several years in the stem, but no evidence of systemic infection was found.

JONES (L. H.). **Relation of soil temperature to chlorosis of Gardenia.**—*J. agric. Res.*, lvii, 8, pp. 611–621, 2 figs., 1938.

The results of experiments carried out in a constant soil-temperature apparatus, at the Massachusetts Agricultural Experiment Station, showed that a chlorotic condition of *Gardenia veitchii* grown under glass, which is stated to have caused serious concern to Massachusetts growers during two previous winters, was consistently induced at soil temperatures of 18° C. or lower, the intensity of the trouble being directly related to decreasing temperature. Traces of chlorosis also appeared at soil temperatures of 20° and 22°, but did not increase in intensity as time went on, and the condition did not develop at higher soil temperatures, independently of the ambient air temperature. Changes in the

length of daylight did not affect the onset of the trouble. It was further found that when the soil temperatures were lowered, hard plants grown at medium soil temperatures developed chlorosis more slowly than soft plants grown at high temperatures. A sharp rise in soil temperature maintained for 13 days was sufficient to start a gradual return of the healthy green colour of the leaves. At soil temperatures as low as 10° and 8° chlorosis only developed in plants that had previously been growing slowly, while plants grown rapidly at high soil temperatures developed a very dark green colour when the temperature was lowered and ceased to grow but set a great profusion of flower buds. There was an inverse correlation between the rate of growth and the intensity of the development of chlorosis.

Schopfer (W. H.) & Blumer (S.). **Untersuchungen über die Biologie von Ustilago violacea (Pers.) Fuck. II. Mitteilung: Wirkung des Aneurins und anderer Wuchsstoffe vitaminischer Natur.** [Studies on the biology of *Ustilago violacea* (Pers.) Fuck. Note II: Effect of aneurin and other auxins of the nature of vitamins.]—*Arch. Mikrobiol.*, ix, 3, pp. 305–367, 2 figs., 13 graphs, 1938.

Continuing their studies (with the collaboration of V. Kocher) on the effect of aneurin and other growth-promoting substances on the biology of *Ustilago violacea* [*R.A.M.*, xvii, p. 247], the writers found that the development of the smut was stimulated not only by aneurin itself, but by all natural plant and animal materials containing the auxin, as well as by extracts of auxo-heterotrophic fungi grown in pure culture with the addition of aneurin or one of its components, pyrimidin and thiazol. The auxin exercises its optimal effects on *U. violacea* at very minute doses compared with those required by other micro-organisms dependent on its presence.

Further details are given concerning the utilization by *U. violacea* of various sources of carbon and nitrogen. The smut made fairly good growth in the refrigerator at 1° C., a fact that may explain the capacity of the sporidia to overwinter in the soil; the optimum temperature appears to be about 22·5°, and the maximum below 28°.

A preliminary note on comparative studies of the growth requirements of ten *U.* spp., here described in greater detail, has already been noticed from another source [ibid., xvii, p. 618].

It is concluded, as a result of these investigations, that *U. violacea* requires for its development the entire aneurin molecule, which can be partially synthesized from pyrimidin and thiazol. Presumably the auxin produces its beneficial effects through the carbohydrate metabolism of the fungus.

Castellani (E.). **Helminthosporium nodulosum Sacc. sul 'Dagussà' in Eritrea.** [*Helminthosporium nodulosum* Sacc. on 'Dagussà' in Eritrea.]—*Agricoltura colon.*, xxxii, 10, pp. 447–451, 2 figs., 1938.

Eleusine coracana plants in Eritrea have frequently been observed to show a spotting of the leaves, and sometimes of the culm and inflorescences [the symptoms of which are described in detail], due to *Helminthosporium nodulosum* [*R.A.M.*, xv, p. 426]. On Eritrean

material the conidiophores averaged 105 by 5 μ and the 4- to 8 (generally 6) -septate conidia 48 by 10 μ.

HYDE (E. O. C.). **Detecting Pullularia infection in Rye-grass seed crops.** —*N.Z. J. Agric.*, lvii, 4, pp. 301–302, 2 figs., 1938.

The low germination commonly found in perennial rye grass [*Lolium perenne*] seed crops in New Zealand is generally due to infection of the grass kernel by a fungus classified as *Pullularia*. The disease is very difficult to detect in the field, the seeds alone being attacked, and the plants often appearing perfectly normal. Affected seed, when machine-dressed, may be of good weight and colour, dry, and devoid of mustiness, and yet be practically worthless owing to low germination resulting from extensive infection.

A method has now been devised by which it is possible to estimate the quality of the seed before harvesting. If about 80 per cent. of the seed is found to be infected, the crop is not worth cutting, but a farmer forewarned in this way is saved the loss involved in harvesting and machine-dressing seed with a very low germinating capacity. The procedure is simple, but must be carried out with care. A few seed-heads are collected from scattered parts of the field, and a few spikelets from scattered positions on each seed-head are removed in the laboratory, each seed being examined microscopically. Infected seeds can be distinguished by the presence of a sticky fluid containing the conidiophores. If the seed is dry, the secretion may have become solid, in which event it is of a waxy consistency, and either clear or pale pink. When rain or dew has washed away the spores, infection is apparent in the dull, rusty-red colour of the grain, which is opaque and appears dark when examined with a diaphanoscope.

Examinations of one area of rye grass at 7- to 10-day intervals gave 10, 28, 44, and 56 per cent. infected seed, the germinating capacity of the crop being 37 per cent.

THURSTON (H. W.) & MILLER (H. J.). **Experiments with liquid lime sulphur for spraying Apples.**—*Phytopathology*, xxviii, 11, pp. 823–832, 1938.

A tabulated account is given of tests conducted in 1937 on 20-year-old Stayman apples in an orchard in Adams County, Pennsylvania, of various lime-sulphur treatments for the control of scab [*Venturia inaequalis*] with a view to the development of a spray programme providing a better balance between scab control and spray injury than that afforded by the standard schedule. The lime-sulphur was applied either by a small or big gun at concentrations of 1 in 50, 1 in 75, 1 in 100, and 1 in 200, with and without the addition of an amendment of hydrated lime at 5 in 100, the treatments being given on 17th April, 3rd and 19th May, 1st, 11th to 12th, and 23rd June, and 16th to 18th July.

The incidence of scab was found to increase progressively with the dilution of lime-sulphur from an average of 2·9 per cent. scabbed fruit at 1 in 50 to 18·1 per cent. at 1 in 200, the control yielding 86 per cent. There was a decrease in foliar injury from 23·1 to 15·3 per cent. with increased dilutions up to 1 in 100 with a renewed sharp rise (43·5 per cent.) at 1 in 200. On an average the big gun caused more damage to the

leaves (26·4 per cent.) than the small one (21·8) and reduced the yield from 13 to 11·6 bush. per tree, but gave nearly 5 per cent. better scab control (7·06 as compared with 12·20 per cent.). The addition of lime to the spray reduced foliar injury from 32·2 to 15·6 per cent. and increased the yield from 11·8 to 12·9 bush. per tree, but slightly favoured the development of scab (10·5 as compared with 8·6 per cent.).

All factors considered, the best combination from the joint standpoint of scab control and avoidance of leaf injury is probably the 1 in 75 dilution.

Reinecke (O. S. H.). **Little leaf of deciduous fruit trees.**—*Fmg S. Afr.*, xiii, 151, pp. 386–390, 2 figs., 1938.

On a recent overseas tour the writer observed little leaf of deciduous fruit trees in the Argentine, New Zealand, and all the Australian States except Tasmania. In Queensland the results of the zinc sulphate treatment [*R.A.M.*, xviii, p. 36] were most impressive. So far the best results under South African conditions have generally been obtained by dormant treatments with concentrated zinc sulphate. For instance, in 1936, Kieffer pears at Stellenbosch responded by a striking improvement to the application of a spray consisting of 16 lb. zinc sulphate per 100 gals. water, while a similarly favourable reaction was shown by Bon Chrétiens at Groot Drakenstein to the same treatment at 25 lb. per 100 gals.; complete recovery from die-back ensued in both cases. Good results were also secured with soil dressings of 21 lb. zinc sulphate per tree of Kieffer pears. In some parts of the Union, peaches and pears have also benefited from dormant applications of a mixture of dilute zinc sulphate and lime. The vine is also stated to be moderately susceptible to little leaf in South Africa.

Phillips (W. R.). **The application of controlled atmospheres in the storage of fruits.**—*Sci. Agric.*, xix, 2, pp. 66–68, 1938.

The author states that McIntosh apples, probably the most important variety in Canada, are very liable to develop core-flush [*R.A.M.*, xvi, p. 820] and other forms of internal breakdown when stored in ordinary atmosphere at 32° F., at which their storage life is the longest. The results of research work, later confirmed by those of semi-commercial trials, showed that by keeping the apples in an atmosphere of 7 per cent. carbon dioxide and 14 per cent. oxygen at 39° their storage life could be extended by the same amount as by keeping them at 32° in ordinary atmosphere, without core-flush developing; under these conditions the apples were slightly superior in quality to those stored at 32°, and were slightly less advanced in maturity according to pressure tests. It is stressed, however, that controlled atmospheres should not be used for prolonging the normal storage life of the McIntosh apple, which should be marketed before the end of January, when its standard quality is at its highest.

Dickson (G. H.). **Some results of mineral fertilizers on Apple seedlings.**—*Sci. Agric.*, xix, 2, pp. 105–109, 2 diags., 4 graphs, 1938.

Details are given of fertilizer experiments since 1932 at the Ontario Horticultural Experiment Station, the results of which showed that the

addition of muriate of potash was definitely effective in improving the condition of the foliage of Salome seedling apples which in 1932 had exhibited severe leaf scorch due to potassium deficiency [*R.A.M.*, xvii, p. 254]. There was clear evidence, however, from mechanical and chemical analyses and examination of the soil profiles round the roots, that this deficiency may be a secondary effect, the primary cause being unfavourable soil or subsoil conditions; in such cases, the application of potassium fertilizers is merely advisable as a means of hastening the recovery of affected trees, a permanent cure only being obtainable by remedying the soil defects as soon as possible.

PRASAD (H. H.). **A note on soft rot of Pears caused by a species of Aspergillus.**—*Indian J. agric. Sci.*, viii, 4, pp. 549–551, 1 col. pl., 1938.

Extensive damage is stated to be caused among pears exposed for sale in Delhi market from July to November by a species of *Aspergillus* closely resembling *A. japonicus* [*R.A.M.*, xvii, p. 796], which produces on the fruits brown, water-soaked spots, $\frac{1}{4}$ to 1 in. in diameter, rapidly expanding and disorganizing the tissues in four or five days. Positive results were obtained in inoculation experiments through needle punctures with fragments of agar cultures. The fungus grows profusely on various solid media at a P_H range from 3·3 to 8.

CHRISTOFF (A.). **Virus diseases of the genus Prunus in Bulgaria.**—*Phytopath. Z.*, xi, 4, pp. 360–422, 11 pl., 1938.

An account is given of the classification and symptoms of virus diseases of drupaceous fruit trees in Bulgaria [*R.A.M.*, xvii, p. 326], based on numerous observations in many nurseries and orchards during a period of over five years. Broad streak and ring-spot variegation, for which Atanasoff's original name of plum pox [ibid., xii, p. 229] is retained, causes the symptoms already described on plum, peach, cherry, apricot, sour cherry (*Prunus cerasus*), greengage (*P. cerasifera* and its var. *pissardi*), and sloe (*P. spinosa*), with slight variations in different fruits and even in different varieties of the same fruit. The author has not so far observed the disease on almond [cf. ibid., xiv, p. 368], the ill-defined spots occurring on this host being attributed to mosaic. Successful transmissions by budding were made from plum to greengage and apricot, from cherry to cherry and *P. mahaleb*, and from *P. mahaleb* to cherry. The symptoms appear very early on single leaves, but often become masked in cool or hot weather, and have also been observed in several orchards on plum, greengage, cherry, *P. mahaleb*, and apricot to be temporarily obscured on the foliage. The virus withstood exposure to a temperature of 59° to 60° C. for 15 minutes, but succumbed after 30 minutes, and after 15 minutes at 65° to 66°. Destruction of infected trees in an orchard in north Bulgaria in 1935 is stated to have given good results. The disease was found to be generally distributed in the south-west, especially in the Kustendil district, where more than 120,000 trees in the nurseries were eradicated.

Narrow-striped and ring spot variegation, believed to be identical with Valleau's virus disease of plum and peach [ibid., xii, p. 454], causes narrow (0·5 to 2 mm.), winding lines, crossing the veins or run-

ning parallel with them, irregular circles, or regular or irregular, light to yellowish-green, small rings on plum, cherry, almond, and greengage leaves in the north and more rarely in other parts of the country. The author has not as yet found the disease on peach. Transmission by budding was successful from plum to greengage and almonds after a maximum incubation period of ten months, but not to pear, apple, or quince. Masked infection with no leaf symptoms was present in the Kustendil plum and Japanese plum (*P. salicina*). The disease is carried over in the grafts taken from infected trees and can be observed from spring to autumn. Destruction of infected trees in 1933 in the State nursery near Loukovit proved to be a successful measure of control. A survey carried out in 1936 in the Pleven district disclosed that about 100,000 trees out of some 5,000,000 were infected, and over 51,000 diseased trees have been destroyed.

Mosaic is believed to be a group of diseases caused by several viruses, three kinds of mottling obtained experimentally being designated ordinary polygonal mosaic mottling, fine to star-like mosaic, and peripheral chlorosis. The symptoms of mosaic vary greatly on different species and also within them, appearing most commonly as fine, polygonal, clearly marked, lighter green to greenish-yellow spots or stripes on the leaves of plum, peach, cherry, apricot, almond, sour cherry, greengage, *P. mahaleb*, and sloe. Sometimes the leaves are deformed, the fruits may show dark green, watery spots, which usually disappear, and may fall prematurely. The symptoms observed on different varieties of the fruit trees mentioned are described in detail. All forms of mosaic are transmissible by budding or grafting, the incubation period lasting for 11 to 12 months. The virus was also successfully transmitted by means of contaminated juice, the incubation period in this case being only two to four months. The star-like mosaic was also transmitted by the seed in an experiment with stones from 56 greengage trees. The symptoms of mosaic appear in spring but often disappear or become disguised by a slight or pronounced chlorosis during the summer. An appended survey of literature shows that the geographical distribution of mosaic diseases of the genus *Prunus* includes Canada, ten States of the United States, South Africa, Czechoslovakia, and Holland. There is some observational and experimental evidence indicating that the mosaic and pox viruses usually manifest themselves separately, their combined action resulting in scorched spots on the leaves.

Discussing the classification of viruses adopted by K. M. Smith [ibid., xvii, p. 52], the author refers the broad-striped variegation to *Prunus* virus 7; and the narrow-striped to *Prunus* virus 7a [both new viruses: cf. K. M. Smith who lists plum pox under *Prunus* virus 5].

Christoff (A.). Кафявото гниене по овощнитѣ дървета въ България. [The brown rot of fruit trees in Bulgaria.]—*J. agric. Exp. Stas Bulgaria*, viii, 3, pp. 3–32, 6 figs., 1938. [English summary.]

The results of numerous observations and the study of many specimens from all parts of Bulgaria showed the presence in the country of four species of *Sclerotinia* on fruit trees. *S. cydoniae* on quince [*R.A.M.*, xii, p. 488] and *S. mespili* on medlar [ibid., xv, p. 703] have only a restricted distribution, and inoculation experiments with the former on

apple, plum, and nectarine were unsuccessful. *S. fructigena* [ibid., xvii, p. 687] is widely distributed throughout the country on both stone and pome fruits, causing chiefly fruit rot and sometimes canker. *S. laxa* [ibid., xviii, p. 120] causes chiefly fruit rot on pome and stone fruits, but wither tip, spur blight, blossom wilt, twig blight, canker, and wilting of the shoots of stools and layers in nursery beds occur only rarely and under such favourable conditions of high moisture as obtain in districts along the Black Sea coast and some of the rivers.

Cultural studies and inoculation experiments with numerous isolations of *S. laxa* from pome and stone fruits, taken from all parts of the plant, indicated the existence of many sub-races, falling into two groups, which seem to be identical with Ezekiel's S_{44} [Wormald's strain of *S. cinerea* f. *pruni* = *S. laxa*] and S_{47} [Californian strain agreeing with Wormald's *S. cinerea* = *S. laxa*] [ibid., v, p. 108]. Cross-inoculations of apple flowers with isolations from plum fruits and of plum flowers with isolations from wilted apple blossoms or fruits gave positive results in each case, and the separation into biological forms *pruni* [*S. laxa*] and *mali* [ibid., xiii, p. 33; xiv, p. 367] is, therefore, believed to be unjustified. By germination tests with spores from numerous specimens of different fruits it was established that *S. fructicola* [ibid., xviii, p. 120] does not occur in Bulgaria.

HENRICK (J. O.). **Leaf rust of stone fruits. Puccinia pruni-spinosae (Pers.).**—*Tasm. J. Agric.*, N.S., ix, 4, pp. 199–201, 1 fig., 1938.

Nectarines and early peaches in the vicinity of the Tamar valley and Hobart, Tasmania, have recently been affected by leaf rust (*Puccinia pruni-spinosae*) [*R.A.M.*, xvii, p. 756]. Observations indicate that the disease may possibly become a serious factor in Tasmania in peach, nectarine, apricot, and plum areas. It is recommended that spraying should be carried out with lime-sulphur (1 in 60) after picking, that all fallen leaves should be ploughed or hoed in during the late autumn, winter, or after pruning, that all peach and nectarine prunings should be burnt, and that spraying with lime-sulphur (1 in 10) or Bordeaux mixture (6–4–40) should be effected in the late dormant period or at the first sign of bud movement; anemones showing yellowing, dwarfing, or twisting should be removed and burnt.

HUBER (G. A.) & SCHWARTZE (C. D.). **Resistance in the Red Raspberry to the mosaic vector Amphorophora rubi Kalt.**—*J. agric. Res.*, lvii, 8, pp. 623–633, 2 figs., 1938.

The authors state that in the course of their studies on the inheritance in raspberry varieties and hybrids of resistance to raspberry mosaic [*R.A.M.*, xvi, p. 518; xvii, p. 377] they observed that *Amphorophora rubi* [ibid., xvi, p. 194], the most important aphid vector of the disease in western Washington, was more abundant on some varieties than on others, and was absent from the variety Lloyd George. The work described in this paper was therefore carried out to determine the practicability of solving the raspberry mosaic problem by breeding for resistance to the aphid in regions where the latter is the principal distributor of infection. The results of greenhouse experiments and field observations showed that aphid resistance was inherited and trans-

mitted when a resistant variety was crossed with a susceptible one. The variety Lloyd George was found to be heterozygous for resistance, and so far no homozygous parent has been found.

DAVIS (M. B.) & BLAIR (D. S.). **The Strawberry and its cultivation in Canada.**—*Fmrs' Bull. Canad. Dep. Agric.* 63, 43 pp., 27 figs. (3 col.), 1 graph, 1938.

This bulletin contains a section (pp. 38–43) by G. H. Berkeley on common strawberry diseases and their control in Canada, giving brief, popular notes on leaf spot [*Mycosphaerella fragariae*: *R.A.M.*, xvii, p. 695], leaf scorch [*Diplocarpon earliana*: ibid., xvii, p. 610], powdery mildew [*Sphaerotheca humuli*], grey mould [*Botrytis cinerea*], 'leak' [*Rhizopus nigricans*], root rot (a complex disorder associated with infection by various soil organisms [including *Ramularia*, *Fusarium*, and *Coniothyrium* spp.: ibid., xiii, p. 173 *et passim*], under the influence of a particular set of environmental factors), June yellows [or suspected mosaic: ibid., xvii, p. 377], and xanthosis [xiii, p. 314; xvi, p. 762]. Among other points of interest may be mentioned the resistance to mildew of the William Belt, Parsons Beauty, Portia, Glen Mary, and Senator Dunlap varieties, and the control of the disease in recent trials at the New York (Geneva) Agricultural Experiment Station by four applications of 85–15 lime-copper dust.

GILLESPY (T. G.). **Studies on the mould Byssochlamys fulva. Progress report.**—*Rep. Fruit Veg. Pres. Sta., Campden, 1936–37*, pp. 68–75, 1938.

Observations during the period under review confirmed previous evidence as to the inability of *Byssochlamys fulva* [*R.A.M.*, xv, p. 170] to parasitize living fruit. In the course of these investigations a number of moulds with the *Paecilomyces* type of conidiophore, closely resembling *B. fulva*, have appeared, necessitating the maintenance of all growths for a fortnight or so before definitely referring them to this species on the basis of ascus formation. The latter process may be accelerated by keeping the cultures at 22° to 28° C. instead of 37°. *Aspergillus* (?) *fumigatus* constantly developed in plantation samples of strawberries heated in the usual way, and also on processed strawberries in glass jars.

The examination of a large number of samples of gooseberries, strawberries, raspberries, loganberries, plums, and blackberries, from orchards in Gloucestershire, Worcestershire, Cambridgeshire, and Surrey disclosed an average of about 5 per cent. contamination for all four counties, gooseberries being slightly less damaged than the other fruits. Samples of strawberry leaves, flowers, and young fruits from one orchard showed no infection in late May and early June, but on 9th June, soon after straw had been laid down, 4 per cent. mould was present; the original source of the ascospores could not, however, be traced with certainty. The average degree of infection on a number of fruit samples arriving at factories and at the Research Station did not differ significantly from that of the orchard specimens. A number of bags used for the transport of gooseberries were found to be infected to the extent of 10 to 20 ascospores per sq. ft., and the mould was also detected in

similar amounts on sugar bags not hitherto used for fruit. Old gooseberry bags inspected in 1936 carried over 200 spores per sq. ft.

In aqueous suspensions of the ascospores from cultures isolated from orchard fruits by 30 minutes' heating at 80°, suspensions were kept at 2° for lengthy periods (up to 18 months) without apparent decline in numbers or loss of heat resistance. About half the ascospores used in the tests germinated in three days after heating at 55°, 60°, and 65° for ten minutes, while positive results were secured in all cases after 24 hours following ten minutes at 75° and 80°. In another series of experiments, in which suspensions were heated for ten minutes at 70°, incubated for varying periods at 37°, and re-heated at 70° for another ten minutes before plating, the germination percentages after one, two, four, and six hours' intermediate incubation in distilled water were 100 per cent. in each case, the corresponding percentages for 2 per cent. sucrose being 100, 100, 95, and 90, and for bottled plum juice 90, 1, 0, and 0, respectively. Inoculated cans of gooseberries and plums, similarly treated, showed no survival after the second heating, when the intermediate incubation period at 20° to 22° exceeded six hours. The maximum thermostability of the ascospores of *B. fulva* was found to coincide with a hydrogen-ion concentration of P_H 5, while at P_H 3 resistance is considerably greater than at neutrality.

In juices from bottles of fruit containing *B. fulva* potato disks often lost all coherence after 24 hours as a result of enzymic activity, no decrease in which could be detected in bottles after several years' storage even when the mould had died out. In contrast to bottles, tins seldom yield any evidence of the enzyme after the current year, and experiments indicated that it is no longer active in gooseberry and plum syrup after 22 and 10 weeks, respectively.

REKO (V. A.). **Die Bananenblatt-Krankheit 'Chamusco'.** [The Banana leaf disease 'chamusco'.]—*Nachr. SchädlBekämpf., Leverkusen*, xiii, 4, pp. 157–170, 13 figs., 1938.

The author gives an account of leaf spot of banana (*Cercospora musae*) as it occurs in Mexico [*R.A.M.*, xviii, p. 124], where it first appeared in 1937, causing yield losses of over 50 per cent. during the first year. The disease was successfully controlled by spraying with Bordeaux mixture (4–4–40), but several disadvantages of using this fungicide are pointed out and better results are expected from a Bayer copper spray at present being tested by the Mexican Government.

MENDEZ (R.). **'Sigatoka'.**—*Rev. agric. Centr. nac. Agric.*, iii, 10–12, pp. 201–207, 1 fig., 1938. [Spanish.]

In connexion with the discovery of banana leaf spot (*Cercospora musae*) [see preceding abstract] in Costa Rica, a popular account is given of the history, distribution, economic importance, and symptoms of the disease in relation to environmental factors, together with directions for its control by spraying the plants with Bordeaux mixture (5 lb. copper sulphate and 6 lb. quicklime in 50 gals. water) with the addition of 2 per cent. linseed oil, 3 per cent. coco-nut oil, or 1 per cent. whale-oil soap as an adhesive. The treatments should be applied whenever there is reason to anticipate a rainy spell or cold nights, six weeks

to two months before the expected onset in humid localities. Some data are given relating to the financial aspects of a spraying campaign, based on the experience of the United Fruit Company in Honduras, where 22 motor apparatuses are in use and perfect control is apparently obtainable by a systematic schedule of six applications, one for each month from June to November. In the writer's opinion, Costa Rican growers may have to sacrifice 50 per cent. of the profits hitherto accruing from the banana crop for the control of 'sigatoka'.

BAKER (R. E. D.). **Studies in the pathogenicity of tropical fungi. II. The occurrence of latent infections in tropical fruits.**—*Ann. Bot., Lond.*, N.S., ii, 8, pp. 919–931, 1938.

In continuation of previous studies (with C. W. Wardlaw) [*R.A.M.*, xvi, p. 395], the writer trapped a large number of fungi on aseptically prepared plates exposed in grapefruit orchards in Trinidad in 1936, including the three common storage pathogens, *Botryodiplodia theobromae* (on all six estates under observation), *Phomopsis* (*Diaporthe*) *citri* (on five), and *Colletotrichum gloeosporioides* (on four); other species present in all the orchards were *Pestalozzia leprogena* [ibid., xiii, p. 455], *Penicillium italicum*, *Trichoderma lignorum*, *Fusarium expansum*, and *Clasterosporium maydicum* [ibid., vii, p. 711]. As already noted by F. E. V. Smith [ibid., xi, p. 508] and Taubenhaus (*Proc. Tex. Citrus Inst.*, iii, p. 89, 1934), *D. citri* and *Diplodia natalensis* are present on the dead wood of citrus trees [ibid., xiv, p. 564], the removal of which reduces the incidence of rotting due to these fungi. The same observations were made in Trinidad, where dead wood also bore conidia of *Colletotrichum gloeosporioides* in relatively small numbers. As an agent of latent infection, *C. gloeosporioides* far outnumbered any of the other fungi under discussion. It attacks the young fruits severely almost as soon as they are set, and has also been isolated from the floral tissues (petals, sepals, receptacles, and stigmas). The available evidence denotes that the development of the fungus is arrested at a very early stage, infection being confined to the superficial layers of the skin. Other common organisms associated with latent infection of grapefruit are *Guignardia* sp. and *Diaporthe citri*, while some importance in this respect may also attach to *F. expansum*.

Latent infection of mangoes was found to be predominantly due to *C. gloeosporioides*, *G.* sp. and *D. citri* also being present. The fruits became infected at an early age, both through the lenticels and the intervening tissues. Other fungi obtained from surface washings of both mango and avocado pears included *Acrothecium lunatum* [*Curvularia lunata*: ibid., xvii, p. 98] (also abundant on grapefruit), *D.* (?) *citri*, *Pestalozzia leprogena*, and *Aspergillus niger* and other *A.* spp. The fungi most commonly present as latent infections of avocado were *Colletotrichum gloeosporioides*, *G.* sp., and *D.* (?) *citri*, the last-named being more common on this host than on either grapefruit or mango. *Botryosphaeria ribis* [ibid., xvi, p. 302] was occasionally detected. Infection both of the lenticels and intervening tissues takes place chiefly in the early stages of growth of the fruit. The large number of *Guignardia* isolations (166 from 33 fruits) is of some interest, since this fungus has not hitherto been recorded as a cause of avocado rot.

C. gloeosporioides and *G.* sp. were further mainly responsible for latent infection of papaw, on which *D.* (?) *citri* was also present to a smaller extent; the cultures were all obtained from fruits approaching maturity. Latent infections of both immature and ripening cacao pods yielded *C. gloeosporioides* and *D.* (?) *citri*. *Phoma destructiva* [ibid., xvii, pp. 139, 373, 418], *G.* sp., and *C. gloeosporioides* were found in green and ripening tomatoes.

Bodnár (J.) & Tankó (B.). **Versuche über die Wirkung von Kalkarsenaten auf die Schwebefähigkeit der Kupferkalkbrühe.** [Experiments on the effect of calcium arsenates on the capacity of Bordeaux mixture for remaining in suspension.]—*Neuheiten PflSch.*, xxxi, 5, pp. 199–203, 2 graphs, 1938.

The results of experiments conducted at the Debrecen (Hungary) Plant Protection Laboratory showed that calcium arsenate solutions with a poor capacity for remaining in suspension exerted a favourable effect on the suspension of the Bordeaux mixture to which they were added, while conversely, calcium arsenates with good suspensory qualities proved to be detrimental to the fungicide.

Reckendorfer (P.). **Über die Wirkungsdauer der Schwefelkalkbrühe. (Ein analytischer Beitrag zur Kenntnis ihrer Zerfallsgeschwindigkeit.)** [On the duration of the activity of lime-sulphur mixture. (An analytical contribution to the knowledge of the rapidity of its decomposition.)]—*Phytopath. Z.*, xi, 4, pp. 423–438, 1 graph, 1938.

In further experiments on the decomposition of lime-sulphur under the influence of oxygen [*R.A.M.*, xvii, p. 332] the amount of thiosulphate sulphur present was determined in 10 c.c. normal strength fungicide diluted with 30 c.c. distilled water and the results calculated as gm. per 100 c.c. of the normal fungicide. It was found that the amount of thiosulphate present increased from 1·86 gm. in the original mixture to 5·60 gm. after 7 hours of exposure to air, gradually falling to 3·20 gm. after 48 hours; the respective amounts of polysulphide and monosulphide sulphur on the other hand decreased from 11·87 gm. and 3·18 gm. to 0·37 gm. and 0·07 gm., after 7 hours. These results were further confirmed by Feigl's microchemical 'iodine acid reaction' test (Akademische Verlagsgesellschaft, Leipzig, 1931). It thus appears that the insecticide component (polysulphide sulphur) would be decomposed about 6 hours after application of the spray, whereas fungicidal activity persists for an almost unlimited period owing to the very slow oxidation of the elementary sulphur.

Beachley (K. G.). **Combining heat and formaldehyde for soil treatment.**—*Bull. Pa agric. Exp. Sta.* 348, 3 figs., 2 diags., 2 graphs, 1937. [Received December, 1938.]

A description is given of a soil sterilization apparatus for combined heat and chemical treatment, operated by a 1 h.p. engine. The formaldehyde solution used is vaporized by being pumped through generator coils heated by an oil-burner, and the vapour produced is led by way of an asbestos hose into an inverted steam-tight pan made of two layers of galvanized iron. In experiments in which pure cultures on rye grains

of an undetermined species of *Fusarium* were placed in soil at different depths, combined formaldehyde and steam was found to kill the fungus at a consistently greater depth than steam alone, the effective depth depending on the time of exposure and the concentration used. Formaldehyde in the form of vapour penetrated the soil to a greater depth than when applied as a drench. The penetration of steam vapour into silt-loam soil was shown to depend on the initial water content of the soil, and assuming that a temperature of 150° F. is essential for killing most pathogenic soil organisms it appears from the experimental data that the temperature resulting from 30 minutes' treatment would be sufficiently high to be effective at a depth of 4 in. in soil with a water content of up to approximately 16 per cent., and at a depth of 6 in. in one of up to approximately 8 per cent. water content. In experiments with 63 greenhouse flats the application of 0·097 oz. of formaldehyde solution, in the form of vapour, per sq. ft. for 15 minutes was as effective against damping-off during and after germination as the steam box method for 90 minutes, and also reduced the need for seed disinfection before planting. It was possible to plant tobacco seed and most vegetable and flower seeds 24 hours after treatment of the seed-beds with formaldehyde combined with steam. Compared with steam treatment of tobacco seed-beds by means of a 16 h.p. steam boiler, the combined formaldehyde and steam treatment gave equally satisfactory results, but the length of treatment was shortened from 30 to 20 minutes (using only 16 oz. of formaldehyde solution per 100 sq. ft.), and the cost reduced from $1 to 80 cents per 100 sq. ft.

American Type Culture Collection. Catalogue of cultures. Fourth edition. 1938.—159 pp., Washington D.C., Georgetown University School of Medicine, 1938.

This catalogue of the micro-organisms maintained by the American Type Culture Collection [*R.A.M.*, vi, p. 742], removed in 1937 to Washington, D.C., includes about 2,600 different cultures now available.

A charge of $2 plus cost of postage and packing is made for each culture, but donors may have access to any cultures deposited by them at any time, or secure others in exchange. Bacteria are dispatched 'frozen and dried', unless a test-tube culture in the active, growing state is specifically asked for. All orders and inquiries should be addressed to the American Type Culture Collection, Georgetown University School of Medicine, 3900 Reservoir Road, Washington, D.C.

Roemer (T.), Fuchs (W. H.), & Isenbeck (K.). **Die Züchtung resistenter Rassen der Kulturpflanzen.** [The breeding of resistant strains of cultivated plants.]—*Kühn-Arch.*, xlv, 427 pp., 2 col. pl., 27 figs., 10 diags., 4 graphs, 1938.

This valuable compilation of outstanding studies in the field of plant breeding for resistance to disease (in the preparation of which the authors were assisted by Dr. [R.] Freisleben, Dr. Krümmel, and Dr. [R.] Thren), is preceded by some general introductory observations and sections on the necessity of breeding for resistance, the pre-requisite biological conditions for the operations involved, the nature of resistance, the modes of its inheritance, and the practical work entailed in its

development. The individual diseases discussed are potato wart (*Synchytrium endobioticum*), potato blight (*Phytophthora infestans*), potato scab (*Actinomyces scabies*), downy and true mildews of the vine (*Plasmopara viticola* and *Uncinula necator*), apple and pear scab (*Venturia inaequalis* and *V. pirina*), bean (*Phaseolus vulgaris*) anthracnose (*Colletotrichum lindemuthianum*) and grease spot (*Phytomonas* [*Bacterium*] *medicaginis*), barley and wheat mildews (*Erysiphe graminis hordei* and *E. g. tritici*), barley stripe (*Helminthosporium gramineum*), cereal rusts (*Puccinia* spp.), including *P. glumarum* on wheat and barley, *P. triticina* on wheat, *P. graminis* on wheat, oats, and rye, *P. lolii* on oats, *P. anomala* on barley, and *P. secalina* on rye, wheat bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*], loose smut of wheat (*Ustilago tritici*), loose and covered smuts of barley (*U. nuda* and *U. hordei*), and oats (*U. avenae* and *U. levis* [*U. kolleri*]), maize smut (*U. zeae*), club root of cabbage (*Plasmodiophora brassicae*), stem rot of clover (*Sclerotinia trifoliorum*), cereal foot rots (*Ophiobolus graminis*, *Cercosporella herpotrichoides*, *Fusarium* spp., and *Helminthosporium sativum*), and flax wilt (*F. lini*). Most of the papers enumerated in the bibliographies at the close of each section have been noticed from time to time in this *Review*. A table is appended showing the method of infection, resistant varieties obtained by breeding, and mode of inheritance of resistance in the case of a number of well-known fungal and bacterial diseases not dealt with under separate headings.

GLENNIE (AGNES E.). **Index to the literature of food investigation.**—Published by Dep. sci. industr. Res., Food Invest. Board, Lond., vii, 1, xiii+371 pp., 1937; ix, 1, v+pp. 1–103, 1938; ix, 2, v+pp. 105–189, 1938; ix, 3, v+pp. 191–280, 1938; ix, 4, pp. 281–422, 1938; x, 1, v+pp. 1–94; 1938; x, 2, v+pp. 95–187, 1938.

These are further numbers of the annotated bibliography of current English and foreign publications on food research [*R.A.M.*, xv, p. 106]. In the first part of Volume x it is stated that it is hoped to complete Volume vii, no 2, and Volume viii, dealing, respectively, with works published in 1935 and 1936, in the next few months. Volume x, no. 1 deals with papers received from January to March, 1938, and in future it is intended to issue parts at quarterly intervals.

KÖHLER (E.). **Über eine neue, im Gewächshaus angetroffene Viruskrankheit ('Glanzkrankheit').** [On a new virus disease ('gloss disease') encountered in the greenhouse.]—*Angew. Bot.*, xx, 5, pp. 373–380, 6 figs., 1938.

In 1933, 1937, and 1938, the writer observed a hitherto undescribed disorder, herein termed 'gloss disease', of greenhouse tobacco, *Datura stramonium*, and potato plants. The leaves of severely diseased Samson tobacco showed marked epinasty, an abnormally dark green coloration, upward curling and undulation of the margins, a 'gooseflesh' roughening of the upper surface, and glossiness of the under side. The stems and leaf edges of older plants display a faint reddish-brown discoloration, accompanied by pronounced torsion of the leaf surfaces. Similar features are characteristic of diseased *D. stramonium* plants. In potatoes the symptoms of gloss disease differ according to the variety, though

glossiness of the under sides of the leaves appears to be common to all. In the case of President, the affected plants assume the stiff, broom-like habit associated with leaf roll, the leaves growing in a sharply vertical direction and the pinnae rolling inwards. The uppermost leaves of the shoot tips are usually curved over the apex; at an advanced stage the whole tip may die and shrivel (acronecrosis), or the middle and lower leaves may wither first (acropetal necrosis), while transitional forms also occur. In Erdgold all the leaves are blunted and chlorotic, the younger ones frequently with a bright gloss on the under sides. Starting from the nodes the stems and petioles assume a brown tint. Typical acronecrosis generally ensues, but in the case of a plant also containing the X virus and another resembling Y, intensive acropetal necrosis developed, i.e., the necrotic symptoms began with the lower foliage as typical 'leaf drop' [*R.A.M.*, xviii, p. 131] and proceeded upwards. In Stärkereiche [Starchy] the leaves and stems of the upper shoot region turn bronze, break and hang downwards, and shrivel. Glossiness in this variety is somewhat less accentuated.

Observations on the epidemic having suggested the implication of whiteflies (Aleurodidae) in the transmission of infection, two healthy tobacco plants were placed in contact with a diseased plant covered with these insects, with the result that the former in due course contracted the typical symptoms of 'gloss disease'. Negative results were given by experiments in the transmission of infection from diseased to healthy plants by means of the sap.

HEINZE (K.). **Beseitigt die Kohlrückstände frühzeitig!** [Remove Cabbage remnants in good time!]—*Obst- u. Gemüseb.*, lxxxiv, 11, pp. 145–147, 4 figs., 1938.

The author has emphasized elsewhere the great importance of excluding the peach aphid (*Myzus persicae*) from the vicinity of German potato fields owing to its activity in the transmission of virus diseases [*R.A.M.*, xviii, p. 133]. This insect is stated to be the vector of about 25 viruses affecting a number of economic and ornamental hosts besides the potato. The remnants of cabbage crops commonly left over the winter in fields, allotments, and the like harbour not only *M. persicae* (in mild situations), but also the cabbage aphid, *Brevicoryne brassicae*, known to be the carrier of six virus diseases, of which the most important are cabbage [ibid., xvi, p. 359; xvii, p. 152] and bean [*Phaseolus vulgaris*] mosaics and onion 'slime' or 'streakiness' [? yellow dwarf: ibid., xvi, p. 724].

COOK (M. T.). **Second supplement to host index of virus diseases of plants.**—*J. Agric. P.R.*, xxii, 3, pp. 411–435, 1938.

This second supplement to the author's host index of plant virus diseases [*R.A.M.*, xvi, p. 114] comprises 42 families, over 120 genera, and nearly 300 species.

OTERO (J. I.) & COOK (M. T.). **Third supplement to partial bibliography of virus diseases of plants.**—*J. Agric. P.R.*, xxii, 3, pp. 263–409, 1938.

This third supplement to the authors' partial bibliography of the literature of plant virus diseases [see preceding abstract] includes papers published in 1937 and 1938.

Esau (Katherine). **Some anatomical aspects of plant virus disease problems.**—*Bot. Rev.*, iv, 10, pp. 548–579, 1938.

This is a critical survey and discussion of 146 recent papers of outstanding importance in relation to certain pathological changes in plant anatomy induced by virus diseases. The subject is treated under the following headings: the nature of the anatomical modifications induced in plants by virus diseases; histology of hosts and the problem of classification of viruses; anatomical aspects of the plant tissue relations of certain viruses; and studies on phloem abnormalities. In conclusion the writer emphasizes the importance of a clear understanding of normal plant anatomy as a foundation for the study of the relationship between virus and host.

Ovcharov [Ovtcharoff] (K.). **On the ferment of pathogenic fungi causing the splitting off of urea from protein.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xx, 5, pp. 377–380, 1 fig., 1938.

In further experiments on the production of urea by fungi [*R.A.M.*, xvii, p. 197] the author demonstrated that an enzyme present in pure cultures of *Verticillium albo-atrum*, *Botrytis cinerea*, and *Pythium de Baryanum* was capable of splitting off urea from gelatine in the presence of toluol and chloroform. The activity of this ferment, for which the name deurease is suggested, was studied on 20-days' old cultures of these three fungi grown on various media and found to be higher on that containing edestin as the source of nitrogen than on those containing glutenin or gelatine. The greater part of the enzyme was retained in the mycelium as endoenzyme and the rest excreted into the nutritive media. The enzyme is considered to play an important part in the assimilation of nitrogen from protein by fungi.

Rennerfelt (E.). **Beobachtungen über den gegenseitigen Einfluss einiger Pilze aufeinander.** [Observations on the reciprocal influence of certain fungi on one another.]—*Svensk bot. Tidskr.*, xxxii, 3, pp. 332–345, 4 figs., 4 graphs, 1938.

In pure culture on a synthetic medium of mineral salts with the addition of various carbohydrates, *Penicillium rugulosum* exerted two diametrically opposite effects on the growth of *Cadophora* [*Phialophora*] *fastigiata*, an agent of blue stain in wood pulp in Sweden [*R.A.M.*, xvii, p. 821], one stimulatory and the other inhibitory, the former due to a rapidly diffusing substance, probably bios, and the latter to one diffusing more slowly and possibly identical with heteroauxin (β-indolyl acetic acid). *P. fastigiata* temporarily retarded the development of *Penicillium rugulosum*, but the latter eventually gained the upper hand and outgrew its antagonist. In mixed cultures the colour of the mycelium of *P. rugulosum* ranged from greyish-green to brick-red according to the carbohydrate supplied, and that of *Phialophora fastigiata* was uniformly red. In mixed cultures with *Rhodotorula glutinis*, *Torulopsis candida*, and *Geotrichoides* No. 103, also isolated from wood pulp [ibid., xvi, p. 575], a temporary stimulus to growth was afforded by *Penicillium rugulosum* only in the case of *T. candida* which, like *Phialophora fastigiata*, grows poorly on a synthetic medium. A red coloration was

imparted to the normally hyaline *T. candida* and *G.* No. 103, whereas *R. glutinis* was deprived of its carotin-forming capacity.

HARDING (DOROTHY) & SCHMIDT (CATHERINE M.). **Boron as a plant nutrient. A bibliography of literature published and reviewed, January, 1936, to June, 1938, inclusive. (With index.)**—83+xvi pp., American Potash Institute, Inc., Washington, D.C., 1938. [Mimeographed.]

This annotated bibliography of the literature of boron as a plant nutrient contains nearly 400 entries.

LESZCZENKO (P.). **Dezynfekcja gleby zakażonej rakiem Ziemniaczanym Synchytrium endobioticum (Schilb.) Perc.** [Disinfection of soil infected with Potato wart disease *Synchytrium endobioticum* (Schilb.) Perc.]—*Roczn. Ochr. Rośl.*, v, 4, pp. 118–119, 1938.

In this summary of a paper read at a conference on plant protection in Poland in 1938 the author states that both light sandy and heavy clay soils, heavily infested with *Synchytrium endobioticum* [*R.A.M.*, xvi, p. 119], were completely sterilized when treated with 0·4 and 0·8 per cent. solutions of formaldehyde (1 and 2 per cent. formalin), applied at a rate of 12·5 l. per sq. m., whereas weaker solutions failed to sterilize the soil completely, although they somewhat reduced the percentage of infection in these plots.

LESZCZENKO (P.) & SZYMAŃSKI (W.). **Wpływ soli potasowych na zmianę wrażliwości kłębów przeciw rakowi Ziemniaczanemu.** [The influence of potassium salts on the degree of susceptibility of tubers to Potato wart disease.]—*Roczn. Ochr. Rośl.*, v, 4, pp. 166–168, 1938.

In a study on the potato wart disease [*Synchytrium endobioticum*: see preceding abstract], conducted in Poland in 1936, tubers of the potato variety Nowa Industria, artificially inoculated by means of fresh tumor material, were planted in plots fertilized with different potassium salts, each plot receiving the same amount of potassium. The data obtained show that in plots treated with potassium chloride (190 kg. per hect.) and potassium sulphate (215 kg. per hect.), only 59·1 and 72·7 per cent. of tubers, respectively, developed the disease as compared with 95·4 per cent. in the untreated control plots. All the other potassium salts tested reduced the proportion of diseased tubers, though to a less degree, except potassium nitrate which increased infection to 100 per cent. When double the amount of fertilizers was used, the percentage of affected tubers was increased by all treatments except potassium chloride and potassium phosphate, which reduced it from 59·1 to 45·4 and from 90·9 to 81·8 per cent., respectively.

BRAUN (H.). **Variationsstatistische Untersuchungen zur Frage der Vererbung von Krebs- und Schorfresistenz der Kartoffel.** [Variation—statistical studies on the question of inheritance of wart and scab resistance in the Potato.]—*Z. indukt. Abstamm. u. VererbLehre*, lxxv, 1, pp. 55–105, 1938.

From this discussion of the [fully tabulated] results of the author's

recent studies at the Biological Institute, Dahlem, Berlin, on the statistical factors involved in the inheritance of resistance to potato scab [*Actinomyces scabies*: *R.A.M.*, xvi, p. 556; xvii, p. 766] and wart disease (*Synchytrium endobioticum*) [ibid., xiv, pp. 465, 788; xvi, p. 119], it appears that in the latter three main groups may be distinguished, viz., (1) containing families derived from selfed lines of susceptible parent varieties or from intervarietal crosses, which yielded 0 to 89·7 per cent. resistant races; (2) comprising families arising from selfed lines of resistant varieties and intervarietal crosses, in which the percentage of resistant races never sank below 50; and (3) consisting of families produced by crosses between resistant and susceptible varieties, giving 5 to 91·4 per cent. resistant races. All the families together fall into six subgroups, two of which comprise less than 50 per cent. resistant races.

In the absence of an exact method of laboratory testing, such as Spieckermann's or Lemmerzahl's for wart disease, the scab data, based on field observations, are admittedly of a tentative and preliminary character. It is obvious, however, that the families derived from intervarietal crosses contracted on the average a lower incidence of infection than the selfed lines of the hybrid partners.

LARSON (R. H.), ALBERT (A. R.), & WALKER (J. C.). **Soil reaction in relation to Potato scab.**—*Amer. Potato J.*, xv, 11, pp. 325–330, 1938.

The general trend of results from the treatments in potato fields infested by scab (*Actinomyces scabies*) in Wisconsin [see above, p. 157] from 1935 to 1937, herein reported and tabulated, confirm previous conclusions as to the reduction of disease with increasing acidity of the soil. In no case, however, was the causal organism eliminated by the maintenance of the hydrogen-ion concentration below P_H 5·0 even for a two-year period. Contrary to Dippenaar's experience (*Sci. Bull. Dep. Agric. S. Afr.* 136, 1933), the broadcast application of sulphur at appropriate rates (from 700 to 3,000 lb. per acre) consistently reduced the incidence of infection in the susceptible Irish Cobbler and Katahdin varieties (the latter used only once in 1936) in three widely differing soil types (silt, sandy loam, and muck). No decline in the amount of scab followed the use of lime, even in quantities beyond the range of economic profitability.

Discussing the practical application of these data, the writers point out that the cost of the sulphur treatment is probably too high for southern Wisconsin muck soils, while in the central districts it should seldom be necessary unless to counteract heavy liming; for the intensive potato-growing Antigo district the reduction of the P_H to 5·2 or 5 by sulphuring is likely to prove effective in scab control.

RACICOT (H. N.), SAVILE (D. B. O.), & CONNERS (I. L.). **Bacterial wilt and rot of Potatoes—some suggestions for its detection, verification, and control.**—*Amer. Potato J.*, xv, 11, pp. 312–318, 2 figs, 2 diags., 1938.

A popular account is given of the symptoms and mode of overwintering and dissemination of bacterial wilt and rot of potatoes caused by an organism closely related to *Phytomonas michiganensis* [*Aplano-*

bacter michiganense] and *P. sepedonica* [*Bacterium sepedonicum*] in Canada [*R.A.M.*, xvi, p. 628], together with directions for its control by the exclusive use of healthy seed, for making smears from diseased plants, and for the collection and dispatch of specimens for purposes of verification.

Chucka (J. A.) & Brown (B. E.). **Magnesium studies with the Potato.**—*Amer. Potato J.*, xv, 11, pp. 301–312, 1938.

The results of experiments in Aroostook County, Maine, from 1930 to 1937 are stated to have proved conclusively that the so-called 'potato sickness' (chlorosis) prevalent in the district is specifically associated with magnesium deficiency [*R.A.M.*, xii, p. 654; xvi, p. 370], and may be effectively combated by the application to the soil of 25 lb. magnesium oxide per acre. Satisfactory control was further obtained by the use of sulphate of potash, magnesia or calcined kieserite. Dolomitic limestone, applied broadcast at the rate of 30 lb. per acre, also assists in the reduction of soil acidity and helps to build up a reserve of magnesium, but the use of high calcium limestone is not recommended, having been almost invariably followed by a depression of yield. Substantial yield increases in Green Mountains and Irish Cobblers (35 and 17 bush. per acre, respectively, in 1934) were secured by the incorporation of magnesium sulphate with the ordinary potato fertilizer, either as a top-dressing or in the spray mixture, particularly in fields where severe chlorosis developed shortly after the emergence of the plants.

Burr (S.) & Millard (W. A.). **Two Potato diseases. Variety trials for resistance to spraing and internal rust spot (canker type) in Potatoes.**—Reprinted from *Scot. Fmr*, 1 p., 2 figs., 11th November, 1938.

In Yorkshire, the form of potato internal rust spot known as 'canker' or the 'canker type' is far more destructive than spraing [*R.A.M.*, xvii, pp. 409, 410]. It is characterized by spots hardly visible at lifting, but which develop later and often break down, with the result that cavities form and the tuber frequently rots. Both conditions occur on light, sandy soil lacking in organic material, but soil analyses do not afford any indication of the importance of this factor; when potatoes were grown in two fields of closely similar soil analyses those from one field developed severe internal rust spot of the canker type, while those from the other were completely unaffected.

In a varietal resistance test in a field where both diseases were known to occur with uniform distribution the varieties most susceptible to spraing were Gladstone, Arran Cairn, and Arran Chief, which showed, respectively, 1, 10, and 15·8 per cent. spraing at the first examination made by cutting the tubers after the crop was lifted, and 2, 10·7, and 15 per cent. at the second, made in February, 1938. The varieties most susceptible to internal rust spot (canker type) were Eclipse, Golden Wonder, Bishop, Kerr's Pink, Great Scot, Gladstone, and Arran Cairn with, respectively, 68·8, 55·5, 53, 61, 59·1, 28·5, and 47·5 per cent. disease in the first cutting and 81·8, 73, 67, 63, 55, 57, and 42 per cent. in the second. The varieties most resistant to 'canker' were Arran Consul, Arran Chief, and King Edward, with 18·1, 19, and 27·2 per cent.

disease, respectively, in the first cutting, and 22·2, 20, and 42 per cent. in the second.

The incidence of spraing in the soil selected was comparatively low, but Arran Cairn, Gladstone, and Arran Chief were too much affected to be grown profitably. The data obtained confirmed observations made over a number of years, that Arran Consul is the safest variety to grow, with respect to 'canker', as it gives a crop that is only slightly affected, even after being stored until spring. On land less liable to 'canker', King Edward may also be grown profitably. There appears to be no relation between the susceptibility or resistance of any variety to spraing and its reaction to 'canker'.

Costa (A. S.) & Kiehl (J.). **Una molestia da Batatinha—'necrose do tôpo'—causada pelo virus de 'vira-cabeça'.** [A Potato disease—top necrosis—caused by the 'vira-cabeça' virus.]—*J. Agron., S. Paulo*, i, 3, pp. 193–202, 3 pl., 1938. [English summary.]

Since 1936 a potato disease (termed 'vira-cabeça') ['twisted head'] of the acronecrosis [*R.A.M.*, xvi, p. 480; and cf. xvi, p. 779] type has been observed in experimental plots in São Paulo, Brazil, and a similar disorder was reported to the writers by Dr. J. Tucker from the Argentine, where tobacco is affected by the 'corcova' ['hunchback'] virus [ibid., xvii, p. 564] to which the potato disease may possibly be due. The tendency of the disease to develop in patches suggests the association of infection with foci of the vector (*Frankliniella* sp.). The symptoms include ring spots on the leaves (which are readily detachable), and spotting of the petioles and peduncles; sections through the last-named sometimes reveal pale ferruginous lesions corresponding with those on the surface. The tubers of diseased plants are similarly affected, both externally and internally. The 'vira-cabeça' virus from Katahdin potatoes was transmitted by rubbing to Geudertheim tobacco and Maule's Earliest of All and Mikado tomatoes, on which the typical symptoms developed. In a preliminary test Katahdin potatoes were infected by viruliferous individuals of the insect vector from diseased tobacco. Although the symptoms of the Brazilian disorder bear some resemblance to those of yellow dwarf [ibid., xvii, p. 701], the ready transmission of the former by insects indicates that the two are not identical.

Sheffield (F. M. L.). **Vein clearing and vein banding induced by Hyoscyamus III disease.**—*Ann. appl. Biol.*, xxv, 4, pp. 781–789, 1 pl., 3 figs., 1938.

The *Hyoscyamus* virus III causes in tobacco [*R.A.M.*, xvii, p. 344] a disease manifested by clearing of the veins followed later by vein-banding. A few days after inoculation a strip up to 1 mm. in width along the principal veins becomes yellow and after persisting for about two days the yellow discoloration becomes diffuse. After about another week dark green bands appear along many of the veins, varying in width from very narrow to several millimetres. Microchemical and other tests of artificially infected young tobacco plants showed that no anatomical or cytological abnormalities occur in the leaves during clearing, the yellow colour of the cleared areas being due to abnormal development or distribution of the chloroplasts. During veinbanding hypoplasia

becomes apparent in the interveinal areas, and considerable hypertrophy in the tissues near the veins. Intracellular inclusions occur in abundance in the phloem, epidermis, and all types of parenchymatous tissue. The virus content per unit volume of cleared tissue was calculated to be about 6 to 11 times as great as that of banded tissue, while the yellow interveinal areas of older leaves contain more virus than the banded ones and less than the cleared.

Borzini (G.). **Osservazioni su due specie di Pythium parassite delle piante di Finocchio (Foeniculum vulgare L.).** [Observations on two species of *Pythium* parasitic on Fennel plants (*Foeniculum vulgare* L.).]—*Boll. Staz. Pat. veg. Roma*, N.S., xviii, 2, pp. 185–194, 2 pl., 2 figs., 1938.

Further studies are reported on the two species of *Pythium* found in the outer covering of the 'bulbs' of *Foeniculum vulgare* plants growing in Italy [*R.A.M.*, xvii, p. 136]. Observations showed that one species (referred to as *Pythium* No. 1) was more actively parasitic than the other (*Pythium* No. 2) and this was confirmed in inoculation experiments. Both attacked only the outer scales of the 'bulbs', the former causing spots on the veins, and the other, greenish-brown discoloration in the tissues adjacent to the wound.

Detailed descriptions are given of the two species of *Pythium*. Both are classified in the *Plerospora* section of the genus but are stated to differ from the two species, *P. diameson* and *P. plerosporon* [ibid., xi, 546] comprising this group. Neither is identified.

Cucurbita pepo plants grown near where the infected fennel had been found showed a serious affection of the collar attributed mainly to *Pythium* No. 1.

Stevenson (J. A.) & Rands (R. D.). **An annotated list of the fungi and bacteria associated with Sugarcane and its products.**—*Hawaii. Plant. Rec.*, xlii, 4, pp. 247–314, 1938.

This is an annotated list of fungi and bacteria recorded on sugar-cane throughout the world. The essential characters of each organism are given, together with its recorded geographical distribution, any synonyms found in phytopathological literature, the original citation, and the reference, where possible, to the description in Saccardo's 'Sylloge fungorum'. The more extensively studied organisms concerned in raw sugar deterioration and sugar-house sanitation are also included.

Abbott (E. V.). **Chlorotic streak of Sugar Cane in the United States.**—*Phytopathology*, xxviii, 11, pp. 855–857, 1 fig., 1938.

In order to secure evidence as to the transmissibility of the disorder recently described as chlorotic streak of sugar-cane in Louisiana [*R.A.M.*, xvii, p. 840], cuttings of three affected varieties were divided into two lots, one of which was immersed in hot water at 52° C. for 20 minutes and the other left untreated as a control. Single-eye pieces from each lot were then planted in steamed soil in an insect-proof greenhouse. All the plants arising from the hot-water treated material emerged in a healthy state and remained sound during a six-month period of observa-

tion, whereas 64 per cent. of those from the untreated control cuttings developed the typical symptoms of the disturbance. In August, 1937, the unreleased seedling varieties C.P. 29/99, 33/229, 33/243, and 33/253 were found to be affected, and a recurrence of infection was detected in the ratoons and plant cane in the following spring; in the first-named variety germination was reduced. In a later survey by R. D. Rands and the writer, 10 to 15 per cent. infection was observed on the commercial variety C.P. 29/320, as well as on other seedlings. At least four parishes of Louisiana are now known to be affected by chlorotic streak, the possible origin of which in the United States is briefly discussed.

Sydow (H.). **Fungi himalayenses.** [Himalayan fungi.]—*Ann. mycol., Berl.*, xxxvi, 5–6, pp. 437–442, 1938.

This is a critically annotated list of 44 fungi (including four new species) with their respective hosts collected in the Himalaya districts Kulu, Lahul, and Spiti by Sultan Ahmad on behalf of the Urusvati Roerich Research Institute, Naggar, Kulu, Punjab, and identified by the author.

Rayss (T.). **Contributions à la connaissance des Urédinées de Palestine.** [Contributions to the knowledge of the Uredineae of Palestine.]—Reprinted from 'Hommage au Professeur E. C. Teodoresco', Bucharest, 1937, 13 pp., 4 figs., 1937. [Received January, 1939.]

Included in this annotated list of 41 rusts collected in Palestine since the author's previous contribution (with T. Săvulescu) to the same subject [*R.A.M.*, xv, p. 683] are four new species [with Latin diagnoses]. Among other records may be mentioned *Puccinia allii* on onion leaves [ibid., xvi, pp. 279, 563] and scales and foliage of *Allium ampeloprasum*; *P. antirrhini*, found in 1936 and spreading with alarming rapidity on *Antirrhinum majus* in Jerusalem and Tel Aviv [ibid., xviii, p. 11]; *P. maydis* on maize [ibid., xvii, p. 671]; *P. scolymi* on *Scolymus hispanicus*; and *Uromyces fabae* on lentils [ibid., xvii, p. 220].

Hiratsuka (N.). **Miscellaneous notes on the East-Asiatic Uredinales with special reference to the Japanese species (IV).**—*J. Jap. Bot.*, xiv, 9, pp. 558–563, 1 fig., 1938.

Included in this further instalment of the author's critically annotated list of eastern Asiatic (mainly Japanese) Uredinales [*R.A.M.*, xvii, p. 347] is *Uredo deutziicola* n.sp. [with a Latin diagnosis], forming inconspicuous, pale yellow, scattered or loosely aggregated, circular spots, 0·1 to 0·3 mm. in diameter, on the leaves of *Deutzia pulchra* var. *formosana*. The new rust differs from the related *U. deutziae* Barcl. in the smaller dimensions of its spores (17 to 25 by 12 to 16 μ).

Hino (I.). **Illustrationes fungorum bambusicolorum.** [Illustrations of Bamboo-inhabiting fungi.]—*Bull. Miyazaki Coll. Agric. For.* 10, pp. 55–64, 10 figs., 1938.

Latin diagnoses, illustrated by drawings, are given of ten fungi found on bamboo in Japan, including *Myriangium bambusae* Hara [*M. haraeanum*: *R.A.M.*, xiii, p. 656] on living leaves of *Pleioblastus pumilis*, *Coccodiella arundinariae* Hara on the same, *Phragmothyrium semiarun-*

dinariae [ibid., xiv, p. 107] on living leaves of *Semiarundinaria fastuosa*, *Asterinella hiugensis* [loc. cit.] on living stems of *Phyllostachys reticulata*, *Chaetosphaeria yosie-hidakai* n.sp. on living stems of *Sasamorpha purpurascentis*, and *Leptosphaeria tigrisoides* on living stems of *P. reticulata*. Two new genera are represented by *Asterotheca nigrocornis* n.g., n.sp. on dead culms of *P. reticulata*, and *Chaetosphaerulina yasudai* n.g., n.sp., on dead bamboo culms.

ENDÔ (S.). **Revised host list of Hypochnus centrifugus Tul. in Japan.**—*Bull. Miyazaki Coll. Agric. For.* 10, pp. 65–82, 1938.

Following up previous studies by himself and T. Watanabe on the host range of *Hypochnus centrifugus* [*Corticium centrifugum*] in Japan [*R.A.M.*, xiv, p. 719], the writer presents a revised list of 216 plants subject to infection by the fungus, of which 28 are new records for Japan, including *Brassica campestris* subsp. *napus* var. *nippooleifera* Makino, *Poa trivialis* f. *folii albovittai*, *Setaria viridis* var. *genuina*, *Phormium tenax*, Buntan grapefruit, and loquat.

NAGORNY (P. I.). Микромицеты Чайного куста. [Micromycetes of the Tea bush.]—*Bull. Georgian Exp. Sta. Pl. Prot., Tbilisi* [*Tiflis*], *1938*, Ser. A, 1, 130 pp., 1938. [German summary.]

In a short foreword L. Kantshaveli states that this book represents a posthumous compilation of Nagorny's notes on the parasitic diseases of the tea bush throughout the world but with special reference to those that have been recorded and studied in the Caucasus since the introduction of tea cultivation in that country [cf. *R.A.M.*, ix, p. 412].

BALLS (A. K.) & MARTIN (L. F.). **Amylase activity of mosaic Tobacco.**—*Enzymologia*, v, 4, pp. 233–238, 1 graph, 1938.

In experiments at the Food Research Division, Bureau of Chemistry and Soils, United States Department of Agriculture, tobacco infected by common or yellow mosaic [see following abstracts] was found to exhibit definite abnormalities in the rate of amylase development, presumably as a result of disturbances in the cell metabolism. Mature Wisconsin Havana plants suffering from common mosaic have a subnormal amylase content of 0·305 $(A)^s$ (saccharifying activity) and 0·035 $(A)^v$ (liquefying activity) as compared with healthy ones (0·514 and 0·122, respectively), while that of plants affected by yellow mosaic is abnormally high (2·22 and 0·370, respectively). The following $(A)^s$ values were obtained in a comparative extraction test on 15-week-old plants 34 days after inoculation with common mosaic: at room temperature (shaken 28 hours at 28° to 30° C.) 0·440; cold (standing four days at 0° to 2°) 0·451, the corresponding figures for healthy plants being 0·440 and 0·654 respectively. The virus protein itself is without effect on the amylolytic activity of either tobacco or malt. Since the evidence for either an inhibitor or activator of tobacco or of malt amylase in the extracts both of healthy and infected tobacco is negative, it may be concluded that the observed differences are in the amount rather than in the intrinsic activity of the amylase formed in diseased tissues.

NORVAL (I. P.). **Derivatives from an unusual strain of Tobacco-mosaic virus.**—*Phytopathology*, xxviii, 10, pp. 675–692, 6 figs., 1 graph, 1938.

Sixty-two variants of Jensen's weakly infectious, non-systemic strain of tobacco mosaic, J14 [*R.A.M.*, xvi, p. 418], were isolated from the original stock by passage through Turkish tobacco, tomato, and *Nicotiana sylvestris*, and were shown by the symptoms they induced on the first-named host to fall roughly into two classes, A (non-systemic) and B (becoming systemic), the former consisting of the local yellow type (N(orval) 1 and 12 other strains) and the latter of (1) slow moving yellow type (N50, 88, 103, 107, 123); (2) fast moving yellow (N4, 8 and 13 other strains); (3) fast moving severe yellow (8 strains); (4) non-distorting green (5 strains); (5) distorting green (14 strains); and (6) necrotic (N2, 80).

These widely divergent variants cover a similar range to those derived by Jensen from tobacco mosaic virus No. 1, exclusive of the green types, which are automatically excluded by his method of experimentation. The slow moving yellow strains N50, 103, and 107 closely resemble J111, being weakly infectious, causing neither vein-clearing nor typical mottle, and producing secondary lesions in the form of isolated yellow spots with green centres, or yellowing radiating from the veins. N88 assumes a distinct position in this group. Like J104 it induced a feebly infectious, slow moving, yellow spotting in tobacco, and minute, necrotic lesions, surrounded by a yellow halo, on *N. glutinosa*. The fast moving yellow strains may be divided into two types on the basis of their severity on tobacco and other hosts. The milder form causes yellow mottling, some foliar distortion, and a tendency to yellow and green ring formation on tobacco, while the severe type, resembling J14D1, induces intense yellowing of the leaves, followed by necrosis of the tissues. On tomato the severe fast moving mosaics cause primary and secondary necrosis, rapidly killing young plants. The necrotic strain N2 differed from J14 in producing systemic symptoms in young tobacco plants and *N. sylvestris*. Tomato plants reacted in a similar way as to J14 except that the growing point was usually spared.

A second group of mutants obtained by L. O. Kunkel in the course of serial transfers of J14 to tobacco over a period of 18 months may also be classified on a symptomatological basis. The A (non-systemic) group is not represented, but the B (systemic) group includes (1) yellow type (none), and the latter (1) slow moving yellow type (K(unkel) 16); (2) fast moving yellow type (K1, 5, 9, 11, 12, and 14); (3) fast moving severe yellow type (K17, 13); (4) non-distorting green type (K10); (5) distorting green type (K2, 3, 4, 6, 7, 8, and 18); and (6) greenish-yellow forming necrotic rings (K15). The slow moving yellow strain K16 approximates closely to N50, 103, and 107 in tobacco, while all produce concentric yellow and green rings on tomato leaves. Among the fast moving types, K1, 5, 9, 11, 12, 14 were indistinguishable from N8 and 4 on tobacco, tomato, *N. sylvestris*, and *N. glutinosa* at greenhouse temperatures of 90° F. and upwards, while K13 appears identical on tobacco and tomato with several of the virulent N types. Necrotic ring type K15, however, is without a counterpart in the N set, producing on tobacco symptoms closely similar to those of E. M. Johnson's ring mosaic [ibid., x, p. 60].

On *N. sylvestris* K 15 produced large, greenish-yellow lesions, becoming completely necrotic, and necrotic spotting of the veins of young leaves, sometimes commencing in the shape of rings. The plants were killed in about a month. On tomato the symptoms closely resembled those caused by N2.

A correlation was experimentally established between rapidity of movement in tobacco and tomato on the one hand and virulence on the other, the local yellow-type strains being weakly infectious, the slow moving yellow intermediate, and the fast moving yellow highly infectious (ten times as much so as the slow moving).

The slow moving yellow and non-distorting green strains were infrequently isolated (6 times each) in comparison with the local yellow, fast moving yellow, severe systemic, and distorting green (13, 21, 13, and 21 times, respectively). The author regards all the above-mentioned strains as mutants, many of which have arisen more than once from the original strain, and advances evidence against the occurrence of any of them as contaminants. By using host plants of differential sensitivity he recognizes factors for necrosis and suggests that a study of virus proteins may throw light on the nature of the gene.

THUNG (T. H.). **Smetstof en plantencel bij enkele virusziekten van de Tabaksplant IV.** [Infective principle and plant cell in some virus diseases of the Tobacco plant IV.]—*Tijdschr. PlZiekt.*, xliv, 5, pp. 225–246, 4 pl., 1938. [English summary.]

Continuing his studies at the Vorstenland Experiment Station, Java, on the protective action of certain tobacco viruses against others [*R.A.M.*, xvi, p. 414], the writer describes two recently detected local forms of white mosaic, termed VIb and VIc, both of Jensen's slow moving type [see preceding abstract], which also includes the Rotterdam B disease [ibid., xvii, p. 632].

Leaves affected by VIb mosaic show dark green, pale green, white, and necrotic areas at maturity, but the younger foliage shows only dark and light green patterns. The infectivity of the juice from the dark green areas is very low or non-existent, the degree of virulence increasing parallel with loss of colour, reaching a maximum in the white areas, and gradually declining in the necrotic regions. The distribution of the virus is restricted to certain cells of the growing points at the top of the plants, so that the actual foci of infection are constituted by only a limited number of cell groups in the newly formed leaves.

The symptoms of VIc mosaic consist of white spots, expanding with age, on the older leaves only: these are the sole source of the infective principle. The juice of young leaves affected by Rotterdam B disease is also devoid of the virus, with which the mature foliage, on the other hand, is completely permeated.

Symptoms of VIb mosaic and Rotterdam B disease develop in the tops of healthy plants inoculated with juice from the most virulent parts of diseased leaves a week and ten days, respectively, after inoculation. The inoculation of healthy foliage with a mixture of 1 c.c. juice from fully grown VIb-diseased leaves and the same quantity from (*a*) ordinary mosaic material, (*b*) white mosaic, and (*c*) Holmes's distorting strain results in the formation of some VIb lesions on the inoculated leaves

only, those produced later showing exclusively the symptoms of the accessory virus. In the case of a similar mixture of VIb and (*d*) ring spot necrosis two or three young leaves following the inoculated ones also contract VIb symptoms but the top foliage exhibits only ring spot lesions. A combination of VIb and (*e*) severe mosaic produces mixed patterns of the two diseases. When the virus of VIb mosaic is inoculated into a given leaf and that of white or severe mosaic or ring spot necrosis into the next ones above or below, VIb symptoms appear both on the inoculated leaf and on the nearest halves of the two next leaves. On the top leaves formed six weeks after combined inoculation with VIb and ordinary or white mosaic and Holmes's distorting strain no symptoms of the first-named virus are to be seen, the other diseases being completely dominant, whereas ring spot permits a slight development of VIb up to the top leaves, and in a combination of VIb and severe mosaic mixed patterns are formed, with the latter somewhat predominating in the uppermost foliage only. When the VIb mosaic virus is inoculated into a given leaf and that of ordinary mosaic, Holmes's distorting strain, or white mosaic into the third leaf above or below, the first-named is entirely superseded by the others in the top leaves. When severe mosaic or ring spot were inoculated into the third leaf above that artificially infected by VIb, symptoms of severe mosaic or ring spot only developed in the treated plants, while the introduction of the severe mosaic or ring spot virus into the third leaf below that inoculated with VIb induced the formation of mixed patterns. The joint inoculation of viruses VIb and white and severe mosaic results in the reproduction of the three virus patterns in the top leaves. On the other hand, in a combination of VIb with white mosaic the latter is completely predominant, while severe mosaic produces a mixed pattern both with VIb and white mosaic. Severe mosaic thus apparently protects VIb against domination by the white virus. The inoculation of either ordinary or white mosaic into young VIb-diseased leaves containing areas without infective juice results in the domination of the former in the top foliage after a month, whereas no extraneous symptoms develop in leaves already pervaded by VIb.

The inoculation of ordinary or white mosaic into very young leaves infected by Rotterdam B virus is followed by the apparent domination of the former; this is, however, merely temporary, being replaced after one month by mixed patterns of Rotterdam B and ordinary or white mosaic. Inoculations of ordinary or white mosaic into older leaves infected by Rotterdam B are unsuccessful. The Rotterdam B virus, when inoculated into very young leaves of plants infected by VIb or any of the other five viruses under investigation, predominates in the early stages of invasion, but after six weeks mixed patterns appear on the uppermost leaves. White mosaic obtains no access to young leaves with apparently pure Rotterdam B symptoms on plants infected with ordinary mosaic, but the first-named virus forms mixed patterns with severe mosaic on inoculation into severe mosaic plants showing apparently pure Rotterdam B symptoms. The Rotterdam B virus is also capable of infecting the older leaves of plants affected by one of the other diseases under discussion, but in such cases there is no initial domination and mixed patterns soon appear. Thus, the infective

principle of Rotterdam B is evidently more powerful than those of the other viruses, but its movement is too slow to ensure complete domination even over the slow moving VIb. In cases of severe attack by Rotterdam B disease the affected plants soon die off, but in milder cases premature flowering results, indicating that the virus probably influences the physiological processes of the plant through the cell protoplasm.

ROSS (A. F.) & STANLEY (W. M.). **The partial reactivation of formolized Tobacco mosaic virus protein.**—*J. gen. Physiol.*, xxii, 2, pp. 165–191, 5 graphs, 1938.

This is an expanded account of the writers' experiments in the reactivation of formolized tobacco mosaic virus protein, a note on which has already appeared from another source [*R.A.M.*, xvii, p. 562].

KAUSCHE (G. A.) & STUBBE (H.). **Über Aktivierungseffekte mit Röntgenstrahlen am Tabakmosaikvirus.** [On the activation effects of Röntgen-rays on the Tobacco mosaic virus.]—*Naturwissenschaften*, xxvi, 45, pp. 740–741, 1938.

The exposure of preparations of varying concentrations of the tobacco mosaic virus [see preceding and next abstracts] to irradiation by X-rays (115 kilovolts, 10 milliampères, 1 mm. aluminium filter) [cf. *R.A.M.*, xvi, p. 347] resulted in an access of virulence as gauged by the numbers of local lesions produced on *Datura stramonium* by the various preparations. Thus, on 16th June, 1938, where the non-irradiated control (1·5 mg. virus per c.c. solution, m/15 phosphate buffer, P_H 7·0) caused the development of 2,969 lesions, the same preparation exposed to 5,000 r induced 3,342. On 12th July the corresponding figures for a 1·08 mg. virus concentration, m/75 phosphate buffer, were as follows: control, 10,000, 12,000, and 14,000 r gave 813, 1,615, 2,859, and 3,659 lesions, respectively. On 23rd July the following results were obtained with a 1·69 gm. concentration, 99·7 per cent. virus protein, salt content below 0·01 per cent., $K = 1{\cdot}5.10^5$; control, 10,000, 18,000, and 19,000 r produced 2,337, 3,773, 5,042, and 2,603, respectively. In one test on *Nicotiana glutinosa* (1·5 mg. virus) on 16th June, the number of lesions was increased from 3,544 to 5,900 by irradiation at 5,000 r.

The following possible interpretations of these observations are briefly considered. (1) The activating effect consists in the multiplication of the number of already existing individual particles per volume unit of dispersion preparation. Such multiplication may be attributed to molecular disintegration caused by the impact of the rays, in which case the virus molecule, as at present understood, would no longer be the last infectious unit. (2) The activating effect resides in the multiplication of the biologically active groups in or on the virus molecule itself, so that fewer molecules are necessary to produce a local lesion. (3) After purification the virus is *a priori* in a partially or completely aggregated form, in which case irradiation would bring about the dissolution and disaggregation of such complexes. The consequence of this process would be an expansion of the active surface due to multiplication of the individual particles, but would in no sense connote an increase of the virus content, reckoned in nitrogen units. Primary irradiation effects

would not here be involved, but the X-rays have been shown by several workers to act in a particular way on the degree of ionization at a surface and produce cryolysis.

It is important that the biological action of the X-rays on the tobacco mosaic virus should not be taken as necessarily applying to virus diseases in general, since preliminary experiments with these rays and ultra-violet light on other viruses have given different results.

KAUSCHE (G. A.). **Über Aktivierungseffekte mit γ-Strahlen am Tabakmosaikvirus.** [On activation effects with γ-rays on the Tobacco mosaic virus.]—*Naturwissenschaften,* xxvi, 45, p. 741, 1938.

In continuation of his experiments with X-rays [see preceding abstract], the writer subjected a preparation of tobacco-mosaic virus (m/30 phosphate buffer 1 : 10, virus content *ca* 0·7 mg. per c.c.) to 1, 2, and 20 hours' irradiation from a gamma-ray mesothorium apparatus (10 mg. radium), with the result that the number of local lesions secured by inoculation on *Datura stramonium* was raised from 167 in the non-irradiated control series to 229, 468, and 272, respectively, the corresponding activity limits being 1 : 12,800, 1 : 102,400, 1 : 409,600, and 1 : 1,638,400, respectively. Attention is drawn to the important fact that there is no necessary correlation between the amount of virus concentration and the severity of infection induced by a given preparation.

SREENIVASAYA (M.) & PIRIE (N. W.). **The disintegration of Tobacco-mosaic virus preparations with sodium dodecyl sulphate.**—*Biochem. J.*, xxxii, 10, pp. 1707–1710, 1938.

A detailed account is given of the writers' experiments at the Biochemical Laboratory, Cambridge, on the disintegration of tobacco-mosaic virus preparation by means of sodium dodecyl sulphate (SDS). By means of an elaborate technique, which is described in full, it was found that besides inactivating the virus and breaking down the protein of high molecular weight, the SDS separates the nucleic acid from the protein to which it was attached. The nucleic acid-free protein, which may be repeatedly precipitated with ammonium sulphate gives all the usual protein colour reactions and precipitates with the ordinary precipitants, while its absorption spectrum approximates closely to that of other proteins, with a maximum at 2,750 to 2,800 Å. and general absorption below 2,500 Å. This is considered to support the view that the intense absorption maximum at 2,600 Å. found in tobacco mosaic and [tomato] bushy stunt [ibid., xviii, p. 143] virus preparations is due to nucleic acid, being absent from the nucleic acid-free protein preparations.

Numerous attempts at fractionation have shed some light on the constitution of the protein of high molecular weight, which is the sole recognizable component of a fully active virus preparation: it seems to disintegrate into a nucleic acid and a protein too large to traverse a cellophane membrane but too small to sediment in a few hours in a centrifugal field of 17,000 times gravity. The evidence so far seems to suggest that the individual submicroscopic rods, from which the rod-shaped aggregates are built up, are themselves composed of a number of similar or identical proteins of normal molecular weight.

Kausche (G. A.). **Über den färberischen Nachweis des Tabakmosaikvirus.** [On the staining test for the Tobacco mosaic virus.]—*Naturwissenschaften*, xxvi, 45, pp. 741–742, 2 figs., 1938.

The following technique has been found effective in the identification by staining of the tobacco mosaic virus [see preceding abstracts]. Expressed juice of diseased and healthy tobacco plants is filtered over animal charcoal and adjusted to P_H 5·5 with 5 per cent. acetic acid in a semi-saturated ammonium sulphate solution. Ammonium sulphate is added in the proportion required to induce precipitation of the virus protein. From a drop of the resultant suspension an air-dry smear is prepared, fixed with alcoholic picric acid, and stained for 24 hours in azure eosin solution (1 : 400); differentiation from the potato virus X [*R.A.M.*, xvii, p. 619] is effected by means of dilute acetone. The fine crystals of the tobacco mosaic virus form a very delicate, well-defined, filiform network, the threads of which are obviously composed of single fibrils. The potato virus X falls into a diffuse protein precipitate of the agglutination type. Ovalbumin and tobacco plant albumin also settle on the slide and react positively to stains, but unlike virus protein, they are more or less readily decolorized by acetone. Both tobacco mosaic and potato virus X take the Victoria blue stain (1 : 1,200) in 20 minutes, but carmines and Feulgen's reagent gave negative results.

Price (W. C.). **Studies on the virus of Tobacco necrosis.**—*Amer. J. Bot.*, xxv, 8, pp. 603–612, 2 figs., 2 graphs, 1938.

A careful search by the writer for the presence of tobacco necrosis virus [*R.A.M.*, xvii, p. 706] in roots of old plants of tobacco, *Nicotiana rustica*, *N. langsdorffii*, and tomato at the Rockefeller Institute, Princeton, New Jersey, was without result, but a single plant out of 180 seedlings raised from tobacco seed supplied by K. M. Smith contained the virus or one very closely allied to it in its roots. This strain was lost, however, before experiments were made with it.

In inoculation experiments with the necrosis virus on Turkish tobacco symptoms developed more rapidly in plants inoculated in the afternoon than in those inoculated in the morning. The minimum incubation period was 18 hours and the maximum 24, or $21\frac{1}{2}$ and 26 hours, respectively, on a less sunny day. No other virus is known to produce symptoms so quickly. When the logarithms of the numbers of lesions produced in the Black variety of cowpea were plotted against those of the dilutions of virus used for inoculation, the points were found to lie reasonably close to a straight line with a slope of about 0·7. The virus from primary necrotic lesions had a dilution end-point of about 10^{-6} and an infectivity, therefore, about 1/10 as great as that of tobacco mosaic virus in the juice of tobacco plants. The thermal death-point was 90° to 92° C. The virus seemed to be fairly stable over a wide range of hydrogen-ion concentrations, although it is suggested that no definite conclusions should be drawn until experiments with purified samples of virus can be conducted. Successful inoculation was achieved by spraying a 1 in 10 dilution of juice containing the virus, by means of an atomizer, over the leaves of Turkish tobacco, *Nicotiana glutinosa*, *N. rustica*, three varieties of bean (*Phaseolus vulgaris*), and cowpea.

large numbers of lesions developing on leaves rubbed with a finger tip or a cheese cloth pad after spraying, and only a few in the unrubbed ones. Natural transmission of the virus was not observed, nor was evidence found for stomatal infection or its transmission by air in spite of abundant opportunity for the virus to get into the air from old infected plants. Under greenhouse conditions excluding accidental infection of roots the virus remained completely localized in inoculated tobacco leaves and does not move to the roots, though these became infected when as little as 0·01 c.c. of the virus was added to the soil. The mode of infection was not determined, but it is suggested that young roots are injured in pushing their way through the soil and the virus may enter through the injured parts, or that the virus may be transmitted by the organisms living in the soil. Cross-immunity tests showed that the tobacco necrosis virus does not belong in the tobacco ring spot No. 1, ring spot No. 2, cucumber mosaic, severe etch, or tobacco mosaic virus groups.

STANLEY (W.M.). **Aucuba mosaic virus protein isolated from diseased, excised Tomato roots grown in vitro.**—*J. biol. Chem.*, cxxvi, 1, pp. 125–131, 1938.

A macromolecular protein was isolated by means of differential centrifugation for 90 minutes at a speed of 24,000 r.p.m. from the juices of aucuba mosaic-diseased tomato roots grown in culture *in vitro*. Its properties [which are discussed in detail] were found to be essentially identical with those of the aucuba mosaic virus protein grown under normal greenhouse conditions [*R.A.M.*, xviii, p. 62]. The concentration reached by the aucuba mosaic virus protein in excised roots *in vitro* was slightly less than that in the roots of greenhouse plants and less than 20 per cent. of that in the foliar tissue of the latter. The isolation of aucuba mosaic virus protein from diseased tomato roots grown *in vitro* demonstrates that the production of virus protein of high molecular weight does not directly depend on the chlorophyll mechanism of a plant, but can proceed in cells supplied exclusively with simple materials of known constitution and structure. The present experiments thus represent an advance in the elimination of certain irrelevant factors tending to obscure the process of virus multiplication as observed in tissues of more complex metabolism.

FERDINANDSEN (C.) & JØRGENSEN (C. A.). **Skovtraeernes Sygdomme. Første Halvdel.** [Forest tree diseases. First half.]—286 pp., 2 col. pl., 124 figs., Copenhagen, Gyldendalske Boghandel, 1938. Kr. 12·50.

The first half of this clearly written, comprehensive treatise on the diseases of forest trees in Denmark is divided into two parts, general and special, the former opening with an outline of fungal development and structure, followed by a survey of the various aspects of infection by parasitic fungi, and the latter (pp. 63–286) comprising descriptions of the various diseases arranged according to the systematic position of the fungi concerned. This very valuable work (the publication of the second half of which is arranged for the spring of 1939) is illustrated by excellent coloured plates and well reproduced photographs.

VERRALL (A. F.). **The longevity of Ceratostomella ulmi in soils.**—*Phytopathology*, xxviii, 10, pp. 763–765, 1938.

After the failure of repeated attempts at the isolation of *Ceratostomella ulmi* from the soil surrounding diseased elm stumps in New Jersey, 7 lots of 10 test-tubes each were partly filled, respectively, with clay loam, clay, sand, swamp muck, hardwood-forest humus, and forest litter, all from the diseased area of the State. Five of the tubes of each soil type were sterilized and all inoculated with *C. ulmi*. Three months later the fungus was isolated from all the sterilized soil samples but not from the non-sterilized ones, with the exception of the forest humus, which gave rise to a sparse growth. After six months *C. ulmi* could still be isolated from the sterilized series, but not from the non-sterilized; all the latter were then reinoculated, but four months later none of them yielded the organism, which survived, however, in 10 out of 35 of the sterilized.

In another test the fungus survived for 120 days in all but one of the sterilized soil samples, but was recovered from only one sample of the unsterilized and this had been stored over calcium chloride.

In a further trial in which humus soil was treated in three ways—sterilized, not sterilized, or sterilized and subsequently re-inoculated with a suspension of its previous organisms—the elm parasite persisted only in the first-named, indicating that its survival is largely dependent on the absence of competing organisms.

The author concludes that even if *C. ulmi* passes into the soil it is unlikely to survive for more than a brief period.

GOIDÀNICH (G.) & AZZAROLI (F.). **Relazione sulle esperienze di selezione di Olmi resistenti alla grafiosi e di inoculazioni artificiali di 'Graphium ulmi' eseguite nel 1337.** [An account of experiments on the selection of Elms resistant to graphiosis and of artificial inoculations with *Graphium ulmi* carried out in 1937.]—*Boll. Staz. Pat. veg. Roma*, N.S., xviii, 2, pp. 149–178, 17 figs., 1938.

This is an expanded account of work already noticed from another source [*R.A.M.*, xvii, p. 636].

SEMPIO (C.). **La cura di Platani fortemente colpiti dalla 'Discula platani' Peck Sacc.** [The cure of Plane trees severely affected by *Discula platani* (Peck) Sacc.]—*Riv. Pat. veg.*, xviii, 9–10, pp. 365–375, 4 figs., 1938.

After referring to the infection of *Platanus occidentalis* trees in Perugia in 1932 by *Discula platani* (*Gnomonia veneta*) [*R.A.M.*, xii, p. 735; xiv, p. 203], the author states that in February, 1933, these trees were subjected to drastic pruning, all the cuts being treated with ferrous sulphate (5 to 6 per cent.) and then tarred. The trunks and branches were next carefully cleaned up and sprayed with Bordeaux mixture (3 to 4 per cent.). During the spring of the same year all the treated trees emitted healthy, vigorous shoots. In the middle of May, all the shoots were removed up to a height of 3 or 4 m. from the ground, the remainder being sprayed with Bordeaux mixture (1 to 2 per cent.). In February, 1934, all undesirable shoots were cut away and this operation was

repeated a year later, when the treated trees were in a highly satisfactory condition.

In 1936 and 1937, fresh and very severe outbreaks of the disease occurred in the same avenue, *P. occidentalis* showing heavy infection, while *P. orientalis* was much more resistant. The outbreaks appear to have been favoured by heavy mists during April in both years. Almost all the trees previously treated recovered, however, and it is concluded that if the pruning treatment is repeated every two or three years the disease will not become endemic, and the trees will continue to make normal growth.

MACDONALD (J. A.). **Fomes fomentarius (Linn.) Gill. [Ungulina fomentaria (Linn.) Pat.] on Birch in Scotland.**—*Trans. bot. Soc. Edinb.*, xxxii, 3, pp. 396–408, 2 pl., 3 figs., 1938.

A study of the fruit bodies of a species of *Fomes* widely present on the trunks and branches of birch trees in the Scottish Highlands showed the species concerned to be *F. fomentarius* [*R.A.M.*, xvi, p. 645; xvii, p. 569, and next abstract]. It differed from *F. igniarius* [ibid., xvii, pp. 358, 763] in the presence of clamp-connexions on the hyphae, its larger spore size, and the absence of setae in the fructification. The colour and character of the spores, and the appearance of the vegetative mycelium differed markedly from those of *F. applanatus* [*Ganoderma applanatum*: ibid., xviii, pp. 2, 4]. Some of the fruit bodies were black and shiny, but as these occurred in close proximity to, or even on the same trunk as, silvery-grey fruit bodies indistinguishable from those found on beech in Canada, it is not regarded as possible to distinguish the two forms of *F. fomentarius* on birch from those on beech or a form *nigrescens* within the types found on birch on the grounds of gross sporophore characters only. When cultures from the dark and light fruit bodies and from infected birch wood were grown in series with isolations of *F. fomentarius* and its var. *nigrescens* from birch and *F. fomentarius* from beech obtained from Ottawa, Baarn, and Princes Risborough there was marked variation in growth rate, rate of colour development, and intensity between the mycelia, but except for variation in luxuriance of growth, no character fell outside the range of those given by C. W. Fritz (*Trans. roy. Soc. Can.*, xvii, p. 191, 1923) for *F. fomentarius*. There were no constant differences between isolations from beech and birch, or between the mycelia of var. *nigrescens* and the typical *F. fomentarius*. All the isolations gave oxidation rings with tannic acid.

The author considers that the reason for the confusion that has existed as to the correct identification of *F. fomentarius*, *F. igniarius*, and *F. nigricans* [ibid., xvi, p. 633] lies in the existence within the species *F. fomentarius* of two superficially distinct types of fruit body marking the extremes of the variations within this species, and occurring at different latitudes. In France, a rapidly growing, soft form occurs on beech. In northern Europe, a more slowly growing, harder, often much darker, type occurs on birch. At the time of his original determination of *F. nigricans*, Fries probably regarded the southern form of *F. fomentarius* as typical of the species, and so gave the new name to the northern European type.

The evidence obtained in these studies proves that distinct varieties

do not occur within the species *F. fomentarius*. The names *F. nigricans* and *F. fomentarius* var. *nigrescens* should therefore be regarded only as synonyms of *F. fomentarius*.

BJØRNEKÆR (K.). **Undersøgelser over nogle danske Poresvampes Biologi med særligt Hensyn til deres Sporefældning.** [Studies on the biology of some Danish Polyporaceae with special reference to their spore discharge.]—*Friesia*, ii, 1, pp. 1–41, 11 figs., 1938. [English summary.]

A comprehensive account is given of the author's studies on the duration of the spore discharge period of some Polyporaceae of common occurrence in Denmark, namely, *Daedalea gibbosa*, *D. quercina* [*R.A.M.*, xvi, pp. 4, 425], *Polyporus adustus* [ibid., xvii, p. 196], *P.* [*Fomes*] *annosus*, *P. applanatus* [*Ganoderma applanatum*], *P. cupreolaccatus* Kalchbr., *P.* [*F.*] *fomentarius* [see preceding abstract], *P. fuliginosus* (Scop.) Fr. [*P. benzoinus* (Wahlenb.) Fr.: ibid., xvi, p. 4], and *P. odoratus* [*Trametes odorata*: ibid., xiv, p. 795]. The spores were collected on a piece of paper enclosed in a capsule and brought into close contact with the hymenial surface of the fruit bodies by a simple contrivance [which is explained].

The nine species under observation fell into four groups in respect of the length of their spore discharge periods, viz., (1) the summer half-year (April to October), comprising *D. quercina*, *G. applanatum*, *P. cupreolaccatus*, and *F. fomentarius*, discharge in the last-named having two distinct peaks, vernal and autumnal, and coming to a partial or total standstill during the heat of summer; (2) the winter half-year (October to March), represented by *P. benzoinus* and probably *P. adustus*; (3) the whole year except February and March (*D. gibbosa* and *T. odorata*); and (4) continuous unless arrested by severe frosts (*F. annosus*).

The spring spores of *F. fomentarius* are considerably larger than those discharged in the autumn (average length 21 as compared with 15 μ), and a similar relationship probably holds good for other Polyporaceae. *F. fomentarius* has been shown by calculations of the annual growth-rate to produce at least two tube-layers, corresponding to the above-mentioned vernal and autumnal peaks of spore discharge. There is considered to be no reliable foundation for reports of the discovery of specimens of *F. fomentarius* more than ten years old. New hosts of the fungus in Denmark are sycamore (*Acer pseudoplatanus*) and alder (*Alnus glutinosa*).

LOHWAG (K.). **Ganoderma resinaceum Boud., Erreger einer charakteristischen Fäule.** [*Ganoderma resinaceum* Boud., the agent of a characteristic decay.]—*Zbl. ges. Forstw.*, lxiv, 10, pp. 258–260, 2 figs., 1938.

In the autumn of 1937 the writer detected fruit bodies of *Ganoderma resinaceum* on externally healthy Turkey oaks [*Quercus cerris*: *R.A.M.*, xvi, p. 4] growing near the rotten stumps of felled oaks in the Lainz Zoological Garden, Vienna. In the following spring a 200-year-old oak was felled and found to be extensively permeated by the same fungus, which proceeded from the base upwards and at a height of 6 in. merged into the brownish-black discoloration caused by *Phellinus* [*Polyporus*]

dryadeus [loc. cit.], a limiting layer separating the portions of the trunk occupied by the two organisms. A remarkable feature of the rot due to *G. resinaceum* is the preservation of the medullary rays long after the intervening tissues are disintegrated and consumed by ants or washed away by rain.

Childs (T. W.) & Kimmey (J. W.). **Studies on probable damage by blister rust in some representative stands of young western White Pine.**—*J. agric. Res.*, lvii, 8, pp. 557–568, 3 graphs, 1938.

The studies outlined in this paper were made to determine the relationship between intensity of infection of the western white pine (*Pinus monticola*) by blister rust (*Cronartium ribicola*) [*R.A.M.*, xvii, p. 572; xviii, p. 73] and degree of damage to the trees, as affected by some of the more important environmental and other factors, and were generally carried out in areas in British Columbia and Idaho where practically all the cankers had originated in a single year or in two consecutive years as indicated by Lachmund's method [ibid., xii, p. 603]. The probable effect on the tree of each canker was calculated on the basis of previous studies by Lachmund on the behaviour of the rust on pines [ibid., xiii, p. 605]. The results indicated that the percentage of cankers capable of causing damage ranged from nearly 100 in the smallest trees to less than 30 in trees from 45 to 50 ft. high, but that the larger trees (up to at least 40 ft.) are much more heavily infected than the smaller, and are therefore more liable to suffer damage. Both the percentage of potentially injurious cankers and the length of time required for the damage to occur may vary within a given height class, according to the width of the crown, the rate at which branches are killed by suppression, and other factors. The investigations are considered to have shown that serious damage to western white pine stands may result from relatively few cankers, and that if these stands are exposed to even moderately severe infection they will be practically destroyed before reaching commercial maturity.

Pierson (R. K.) & Buchanan (T. S.). **Susceptibility of needles of different ages on Pinus monticola seedlings to Cronartium ribicola infection.**—*Phytopathology*, xxviii, 11, pp. 833–839, 1938.

From 7th September to 11th October, 1933, at Deep Creek, Idaho, 34 potted native *Pinus monticola* seedlings, ranging from 5 to 7 years of age and from 7 to 15 in. in height, were exposed to infection by *Cronartium ribicola* [see above, p. 149] from the highly susceptible *Ribes petiolare* [*R.A.M.*, xvii, p. 143], dense bushes of which were growing in such a way as to form an almost closed leafy canopy over the trenches occupied by the pines. After a minimum incubation period of 66 days the incidence of the resultant needle spots was computed in relation to the age of the infected material. The current season's needles were found to be comparatively resistant (the average number of spots per 100 sq. cm. surface area being 1·3) [cf. ibid., xvi, p. 287], those of the second and third years relatively high and approximately equal in susceptibility (18·9 and 18·8), while the few fourth-season needles represented were intermediate in their reaction, but with a tendency to susceptibility (12·4).

Wright (E.). **Further investigations of brown-staining fungi associated with engraver beetles (Scolytus) in White Fir.**—*J. agric. Res.*, lvii, 10, pp. 759–773, 4 figs., 2 graphs, 1938.

In continuation of his studies on the brown stain in white fir (*Abies concolor*) caused by *Trichosporium symbioticum* [*R.A.M.*, xiv, p. 666], and associated with egg galleries of *Scolytus ventralis*, a somewhat similar but lighter brown stain in the same host was observed in connexion with the egg galleries of *S. praeceps* and *S. subscaber*. The egg galleries of all these beetles are confined to the cambial region, but those of *S. ventralis* are found at the base of the trees, those of *S. praeceps* at the top, and those of *S. subscaber* in the branches. Isolations from the stained bark and adjacent sapwood and from newly emerged beetles indicated that the stain associated with *S. praeceps* and *S. subscaber* is caused by a fungus identified as *Spicaria anomala*, while *T. symbioticum* was again observed to be constantly associated with *Scolytus ventralis*. In ten different trees inoculated with cultures of both fungi the average visual longitudinal spread of *Spicaria* stain was found to be 3·5 mm. per week, that is about one-half as fast as the spread of the *Trichosporium* stain in the same tree. It was also observed that *S. anomala* killed the cambium, thus apparently helping the beetle to invade the trees. The reaction of the two fungi to physiological conditions did not show significant differences. Wood stained by *T. symbioticum* was found to contain only three-fifths, and that stained by *S. anomala* less than one-half, as much moisture as that present in unstained wood of the same tree. It is conjectured that each fungus may serve to maintain a moisture balance favourable for the broods of their respective beetle associates.

Jump (J. A.). **A study of forking in Red Pine.**—*Phytopathology*, xxviii, 11, pp. 798–811, 3 figs., 1 graph, 1938.

Pursuing his studies on the abnormal bifurcations of red pine (*Pinus resinosa*) in New York State and other parts of the north-eastern United States, the writer presents further information on the disorder supplementary to that already noticed from another source [*R.A.M.*, xvii, p. 494]. Among the organisms isolated from diseased trees was a species of *Tympanis*, which appeared from comparative cultural studies to be identical with Hansbrough's material of *T. pinastri*, causing canker of the same host [ibid., xvi, p. 289]; in the majority of cases the fungus presumably enters the tree through fissures resulting from forking. *Dematium* [*Pullularia*] *pullulans*, however, was the organism most consistently isolated from various parts of infected trees, including the lateral and terminal buds, pith and discoloured surrounding wood, and discoloured wood of the root crown. In inoculation experiments on young trees with conidial suspensions of the fungus, reisolations were effected after five weeks from the stem at distances of 1 to 2 cm. from the site of infection.

By means of Granick and Dunham's technique (consisting essentially in the measurement, after four days' exposure to light, of the longitudinal growth increments in the upper centimetre of a 7 to 8 cm. etiolated, decapitated lupin hypocotyl, to the cut surface of which the test substance is applied in lanoline paste or agar), *P. pullulans* was found

to contain a growth-promoting substance in quantities exceeding those present in the other organisms investigated, viz., Fleischmann's yeast, *Fusarium* sp., *T. pinastri*, and *Polyporus schweinitzii*. On this basis it may be supposed that abnormal growth of a pine bud can be initiated through the action of a phytohormone produced by the fungus living within the tissues.

No definite correlation could be established between the incidence of forking and environmental conditions, though the fact that the lowest percentage of diseased trees occurred at high altitudes in the northern part of the area inspected suggests the implication of temperature and latitude as limiting factors in the development of the disturbance.

Campbell (A. H.) & Vines (A. E.). **The effect of Lophodermellina macrospora (Hartig) Tehon on leaf-abscission in Picea excelsa Link.**—*New Phytol.*, xxxvii, 4, pp. 358–368, 2 pl., 1 fig., 1 graph, 1938.

In discussing the factors preventing needle fall in the α form of the disease produced on *Picea excelsa* [*P. abies*] by *Lophodermellina macrospora* [syn. *Lophodermium macrosporum*: *R.A.M.*, xvii, p. 421], the authors describe the mechanism of abscission in the normal needle as follows. The needle is borne on a peg-like cushion, above which is a clear hyaline layer encircling the base of the needle. Between the cushion and hyaline layer is a layer, not exceeding two cells in width, composed of small, irregular, thick-walled cells, called tooth cells, which become red on staining with Sudan III, indicating the presence of cutin-like material. The hyaline layer consists of much larger cells of the stone cell type with small lumina and very thick lignified walls. The cells are elongated parallel to the longitudinal axis of the needle, the contraction of the walls thus taking place at right angles to the needle axis. The hyaline layer is regarded by the authors as a part of the hypodermis and the tooth cells a modified continuation of the epidermis, the entire needle being thus enclosed in a sheath of sclerenchyma except at the entrance of the vascular track.

From the experiments with both living and dead twigs it appeared that the abscission of the needles under drying conditions depended upon the hygroscopic contraction and the resulting separation of the hyaline layer from the tissues of the cushion following water loss from the needle. The exact amount of water lost from the needle is not, however, the decisive factor, but rather the difference in loss of water between the hyaline layer and the cushion, the fall of the needles occurring when the water loss from the needle is considerably in excess of that from the cushion. A brown substance suggesting wound gum was found filling the vascular track in the cushions from which needles had fallen recently, but was absent in the cushions of living needles. It is believed to bring about normal needle fall by stopping the water-supply to the needle and thus inducing the abscission mechanism to function.

The material used in this study was collected from a 30 years' old plantation of *P. abies* at Ballindalloch, Banff, Scotland. The needles affected with the α form of the disease showed a black ring round the base, and occasionally one or more close to the tip, whereas in those affected with the β form (in which the needles fall) these rings were absent. In a longitudinal section through the needle base the black

rings were seen to cover the whole region of the hyaline layer, the chief cause of the blackening being a dark brown pigment produced by the dark brown hyphae, 3 μ in diameter, observed in the lumina of the cells; these hyphae aggregated into a thin, pseudoparenchymatous partition, about 20 μ thick, across the needle, becoming much more substantial in the vascular bundle. All stomata of the whole needle were found to be completely blocked by black, pseudocollenchymatous plugs, the substomatal sclerotia. The retention of needles is explained by the greatly reduced rate of water loss from the needle, brought about by the blocking of the stomata by the substomatal sclerotia and the presence of the mycelial plugs at the base and sometimes near the tip of the needle, by which means the needle is converted into a kind of sclerotium.

RŮŽIČKA (J.). **Doklad o škodlivosti nesprávného původu Smrkového semene.** [Proof of the harmfulness of using Spruce seed from inappropriate sources.]—*Lesn. Práce*, xvii, 10, pp. 533–539, 1 fig., 1938. [German summary.]

The author reports that a stand of Norway spruce [*Picea abies*] of 20 hect., planted before 1906 on different types of soils at an altitude of 715 m. above sea-level near Pacov in southern Bohemia, became stunted and was partly destroyed by *Ascochyta piniperda* [*R.A.M.*, xvii, p. 567], while adjacent stands, planted after 1906 grew well. The spruce seed used before 1906 was obtained from Viennese and Tyrolese firms, and was most probably of Alpine origin, whereas after 1906 the seed was usually bought from Czech firms, and mostly originated in the comparatively low Šumava mountains. It is concluded that the spruce stands planted from Alpine seeds become stunted and readily succumb to attacks of *A. piniperda*.

It is intended, after clearing the present stand, to replant it with other conifers, since Norway spruce, even of suitable origin, is too liable to contract infection in this heavily infested district.

GARREN (K. H.). **Studies on Polyporus abietinus. I. The enzyme-producing ability of the fungus.**—*Phytopathology*, xxviii, 11, pp. 839–845, 1938.

The coniferous sapwood-destroying fungus *Polyporus* [*Polystictus*] *abietinus* [*R.A.M.*, xvii, p. 196] was shown by *in vitro* and *in vivo* tests to form 15 of the more common hydrolytic enzymes, viz., emulsin, cellulase, ligninase, amylase, sucrase, maltase, inulase, pectinase, tanninase, pepsin, trypsin, erepsin, urease, asparaginase, and lipase, and four belonging to the oxidizing group, namely, oxygenase, peroxidase, laccase, and catalase.

A comparison of *P. abietinus* with the records of 17 well-known wood-destroying fungi in respect of enzyme production reveals a more copious output by the former than by any of the others tested except *Lenzites sepiaria*.

The variety of hydrolytic enzymes secreted by *P. abietinus* suggests that the materials (including glucosides, sucrose, and proteins) stored in the wood parenchyma are of considerable importance in the nutrition of the organism.

The *in vitro* method of testing (involving culture on autoclaved loblolly pine [*Pinus taeda*] sawdust and extraction of the enzyme) was found to afford more accurate information than the *in vivo* tests (on cultures grown on synthetic media plus a suitable substance, e.g., urea for urease) as to the total number of enzymes produced by a given fungus.

PALÉN (A. G. P.). **Arseniken och dess användning för träkonservering och växtskyddsmedel.** [Arsenic and its utilization as a wood preservative and plant protective.]—*Tekn. Tidskr.*, lxviii, 32, pp. 375–378, 2 figs., 1 graph, 1938.

Further particulars are given of the writer's experiments at a Swedish mining concern on the practical application of his newly developed method of coniferous wood preservation by means of metal arsenates [*R.A.M.*, xv, p. 623]. The following percentages in relation to the dry wood substance were the safety limits for the effective control of *Coniophora cerebella* [*C. puteana*], *Merulius lacrymans*, and *Lentinus squamosus*, respectively, in tests on impregnated wood blocks [loc. cit.] with the arsenic compounds and three standard preservatives: calcium arsenate 0·033 to 0·08, 0·08 to 0·16, and 0·08 to 0·42; barium arsenate (*C. puteana* and *M. lacrymans*) 0·015 to 0·036 and 0·047 to 0·07, respectively; magnesium arsenate (*C. puteana*) 0·042 to 0·097; chromium arsenate (*C. puteana* and *M. lacrymans*) 0·025 and 0·16, respectively; zinc arsenate 0·034 to 0·04, 0·07, and 0·077 to 0·15, respectively; manganese arsenate (*C. puteana* and *M. lacrymans*) 0·04 and 0·014 to 0·031, respectively; copper arsenate (*C. puteana*) 0·03; zinc chloride 0·6 to 1·6, 0·6 to 1·54, and 0·7, respectively; zinc-meta-arsenite (*C. puteana* and *M. lacrymans*) 0·035 and 0·04 to 0·08; and creosote (*C. puteana* and *L. squamosus*) 1·3 to 6·8 and 10 to 12·7, respectively.

Of the various modes of application tested, the most practical was found to consist in the introduction into the wood of ortho-arsenic acid combined with the several arsenates in such a way as to produce insoluble arsenate in the wood on reaction with its constituents, impregnation being carried out under pressure. The treatment is stated to involve no risks due to the poisonous character of the compounds and to compare favourably with creosote from the standpoint of economy.

BRECHT (W.), SCHRÖTER (H.), & SÜTTINGER (R.). **Holzschliff aus angeblautem Kiefernholz.** [Wood pulp from blued Pine wood.]—*Papierfabrikant*, xxxvi, 41, pp. 423–425, 1 graph, 1938.

A tabulated account is given of experiments at the Darmstadt (Germany) Technical College to determine the effect of blue stain (*Ceratostomella* spp.) on the pulp obtained from severely diseased 50- to 55-year-old pine wood in comparison with the product of similar healthy material. The defect was found to cause no perceptible loss of strength [cf. *R.A.M.*, xv, p. 185], nor were the sheets of paper prepared from the stained pulp lacking in resistance to stress as compared with those from the controls—rather the reverse, in fact. The sole drawback to the utilization of stained pulp lies in the dull greyish-blue coloration, which it may be possible to counteract by a special bleaching process.

FINDLAY (W. P. K.). **The natural resistance to decay of some Empire timbers.**—*Emp. For. J.*, xvii, 2, pp. 249–259, 1 pl., 1938.

A full account is given of tests carried out at Princes Risborough to determine the resistance to fungal decay of all species of timber received from different parts of the British Empire. In the laboratory tests, small pieces of wood, 10 by 2·5 by 1·25 cm., are cut and planed with the long axis parallel to the grain, heated for 18 hours at 100° C., weighed aseptically, and immediately placed on actively growing cultures of the test fungi on 2 per cent. malt agar medium in special culture flasks. Ten samples are tested against each species of fungus, two samples being inserted into each flask. The flasks are maintained at 22°, sterilized water being added as required to a reservoir in the neck. After four to eight months, the blocks are removed and their final dry weight and moisture content determined. The loss of dry weight due to infection is then calculated as a percentage of the original dry weight. The fungi used included *Merulius lacrymans*, *Coniophora cerebella* [*C. puteana*], *Polystictus versicolor*, *Lenzites trabea*, *L. sepiaria*, *P. sanguineus*, *Poria vaillantii* [*R.A.M.*, xviii, p. 76], and *Lentinus lepideus*. The results obtained in recent tests on 52 timbers are tabulated in full, the species very resistant to decay including *Baikiaea plurijuga*, *Chlorophora excelsa*, *Dryobalanops aromatica*, *Ocotea usambarensis*, *Peltogyne porphyrocardia*, and seven others. Field tests, in which small stakes were driven into the ground to a depth of 12 in., are in progress, and preliminary observations indicate that they will confirm the laboratory experiments.

The durability of the heartwood of most timbers is due mainly to the presence of certain extractives, soluble in water, alcohol, or benzol, which are formed as the sapwood is changing into heartwood, and are toxic to wood-destroying fungi.

No direct relationship exists between the specific gravity and durability of timbers, though most very heavy timbers tend to be durable, and most light ones are susceptible to fungal decay. Within any one species it is probable that the higher the density the more durable the timber. As a general rule, dark timbers are more resistant than light ones.

LOHWAG (H.). **Mykologische Studien—XIV. Zur Anatomie des Strangmyzels von Gyrophana lacrymans (Wulf.) Pat.** [Mycological studies—XIV. On the anatomy of the strand mycelium of *Gyrophana lacrymans* (Wulf.) Pat.].—*Ann. mycol., Berl.*, xxxvi, 5–6, pp. 401–434, 6 figs., 1938.

The author gives a revised description of the mycelial strands of *Gyrophana* [*Merulius*] *lacrymans* [*R.A.M.*, xvii, pp. 282, 641, 785], based on the studies by Falck (Die Merulius Fäule des Bauholzes. 1912), but incorporating new observations. The fungus is stated to possess a tufted mycelium with hyphae characterized by tendril-like side branches, which become intertwined and thus form strands. These strands consist of several types of hyphae: the fibrous hyphae have thick walls, measure 4 to 5 μ in diameter, are non-septate, and form a well-defined fibrous cortex; the vessel (or sap) hyphae have no septa or clamp-connexions, but form metasepta and irregular thickenings in the walls, and are sometimes lobed in cross-section; the tube hyphae become thinner

at both their ends and are filled with albumin in the form of crystals or as an amorphous mass; and the structural threads are septate hyphae with clamp-connexions and thin walls, and are filled with protoplasm. The last-named are capable of giving rise to the other types of hyphae.

The growth of the strands is very rapid, amounting at optimal temperatures of 18° to 22° C. to 1 cm. in two days. The strands serve the fungus as channels for transporting nutritive substances, but they can sometimes form temporary sclerotia. Falck distinguished such compound mycelial strands in the Basidiomycetes from true rhizomorphs under the name of syrrotia, basing this distinction on certain developmental and morphological characters, namely, that rhizomorphs did not originate by the intertwining of hyphae but were from the first individual structures with terminal growth, and also that they possessed no vessel or fibrous hyphae and were hollow in the middle. The author discusses these points at length, drawing examples from many sources, and comes to the conclusion that they are not supported by a closer examination of the evidence and that mycelial strands having the structure described above can be included in the term rhizomorph.

Parris (G. K.). **The diseases of truck crops in Hawaii.**—*Ext. Bull. Hawaii agric. Exp. Sta.* 33, 78 pp., 42 figs., 1938.

In this popular booklet on the diseases of vegetables in Hawaii the outstanding symptoms, etiology, and the most recent methods of control of the various diseases are discussed and their economic importance indicated.

Arruda (S. C.). **A podridão parda da Couve Flor.** [Grey rot of Cauliflower.]—*Biologico*, iv, 10, pp. 343–344, 1 fig., 1938.

Attention is briefly drawn in popular terms to the occurrence in Campinas, Brazil, of a grey rot of cauliflower heads due to *Alternaria brassicae* [*R.A.M.*, xvii, p. 284], the direct control of which presents considerable difficulty owing to the risk of depreciation of the marketable product by fungicidal sprays. Treatment of plants destined for seed production with 1 per cent. Bordeaux mixture is admissible, but in general the most reliable means of combating the disease consists in protracted crop rotation (four to five years).

Gibbs (J. G.). **A technique for studying the longevity of Phoma lingam in the soil.**—*Phytopathology*, xxviii, 10, pp. 762–763, 1 fig., 1938.

At the Plant Research Bureau, New Zealand Department of Scientific and Industrial Research, Palmerston North, roots of Superlative swedes were topped, washed, incised with a sterile scalpel, and immersed in groups of four in one of a graded series of aqueous spore suspensions of *Phoma lingam* [*R.A.M.*, xiv, p. 54; cf. also ibid., xvii, p. 297] containing from one spore per 10 c.c. to 100,000 per 1 c.c. Typical dry rot lesions developed on swedes steeped in suspensions with 5 spores per c.c. and upwards, the maximum incidence of infection (100 per cent.) being secured at a concentration of 100,000 per c.c. In this series the fructifications of the fungus appeared on the roots within 12 days instead of the normal period of six weeks and two months required when inoculations are made from agar cultures on swedes and potato dextrose agar,

respectively, at 21° C. In soil tests aqueous suspensions were made with soil collected within 1 ft. of infected swedes and also from the same sites two months after removal of the roots. Heavy infection by *P. lingam* occurred in both series of suspensions. The new technique facilitates the study of the longevity of the dry rot fungus in the soil, which was formerly complicated by the liability to extensive contamination in dilution plates and the slow growth of the organism in culture.

TOMPKINS (C. M.). **A mosaic disease of Turnip.**—*J. agric. Res.*, lvii, 8, pp. 589–602, 4 figs., 1938.

An account is given of the author's comparative studies carried out in greenhouses in Berkeley, California, of the turnip mosaic [*R.A.M.*, xvii, p. 574] prevalent on Long Island, New York, with virus diseases of cruciferous crops in California. The disease was transferred by mechanical inoculation to healthy Purple Top White Globe turnip seedlings and the symptoms produced by this virus are stated to have remained unchanged through successive monthly transfers since 1934, when the investigation was started. On seedlings of the above-named turnip variety the initial symptoms consist of a conspicuous, coarse, systemic clearing of the veins, with interveinal mottling; the leaves show marked crinkling and slight dwarfing; and the plants are stunted in the early stages of infection. As the leaves expand, the coarse yellowing is superseded by a preponderance of very dark green, irregular, raised islands, interspersed with a restricted amount of chlorotic tissue. Crinkling of the leaves is accentuated and subsequently the dark green islands are almost entirely replaced by chlorotic, light green areas. No lethal effect of the infection was observed on this or any other susceptible host. Under greenhouse conditions the turnip mosaic was readily transmitted by *Myzus persicae* and *Brevicoryne brassicae*, or by mechanical inoculation using carborundum as an abrasive; the incubation period ranged from 13 to 21 days. The virus was inactivated after ageing for three days *in vitro* at 22° C. Its inactivation temperature (10 minutes' exposure) is between 60° and 63°, and its tolerance to dilution is 1 in 3,000. The host range of the virus, as far as established, includes 18 species of plants representing 12 genera in 6 families; 11 of the species belong to the Cruciferae and include, among others, cabbage, cauliflower, rutabaga, Chinese cabbage (*Brassica pe-tsai*), annual stock (*Matthiola incana* var. *annua*), and Chinese radish. From a careful review of the literature dealing with the viruses of turnip and rutabaga, the author believes that the question of the identity of the viruses described cannot be solved on the basis of the information available so far, and that any definite conclusion would not be justified.

FOX (D. E.). **Occurrence of the Beet leafhopper and associated insects on secondary plant successions in southern Idaho.**—*Tech. Bull. U.S. Dep. Agric.* 607, 43 pp., 4 graphs, 1938.

Studies carried out from 1928 to 1933 on the successions of plant cover on newly abandoned lands in southern Idaho and on the general breeding area of the beet leafhopper (*Eutettix tenellus*), which is of great economic importance as the vector of curly top of beets, tomatoes, and other cultivated crops [*R.A.M.*, xviii, p. 78 and next abstract]

demonstrated the significant part played by annual weeds in the production of large populations of this and other injurious insects. *E. tenellus* was found to be mainly supported by Russian thistle (*Salsola pestifer*), flixweed (*Sophia parviflora*), and tumblemustard (*Norta altissima*), but was also able to make use of sagebrush (*Artemisia tridentata*) as a temporary or 'hold-over' host during the autumn and other periods when more congenial hosts are unavailable.

MURAYAMA (D.). **Physico-chemical properties of the virus of Broad Bean mosaic.**—*J. Fac. Agric. Hokkaido Univ.*, xliv, 1, pp. 1–32, 1 pl., 1938.

A fully tabulated account is given of studies on the physico-chemical properties of the broad bean mosaic virus [*R.A.M.*, xvii, p. 645] carried out from 1935 to 1937 at the Morioka Imperial College of Agriculture and Forestry and the Hokkaido Imperial University, Japan. The virus lost its infectivity (gauged by needle-prick inoculation experiments on young broad beans of the Issun-Soramame variety) at dilutions exceeding 1 in 1,000, while ten minutes' heating at 63° C. also resulted in a substantial diminution or total inactivation of the infective capacity of the juice. The virus was destroyed by 21 to 25 days' ageing *in vitro* at room-temperature or 15 to 20 days in the incubator at 25° to 28° C.; the addition of a drop of toluol to the juice not only failed to maintain it in a virulent condition but actually accelerated the loss of infectivity, which took place after 8 days. Rapid inactivation of the virus further occurred in diluted plant extract. The infective principle withstood 20 to 25 and 25 days' desiccation in the plant tissues during the summer and winter, respectively. The virus succumbed to half-an-hour's exposure to 1 per cent. formaldehyde and, except in one instance, to 50 per cent. alcohol. The infectivity of the broad bean mosaic virus was at its height at P_H 4 to 8 and rapidly declined when the alkalinity or acidity of the suspension was increased to P_H 9 or 3, respectively. The virus failed to traverse the coarse porcelain filters, Shofer L1 and L2. The Japanese broad bean mosaic virus appears to approximate to Osborn's pea virus 2 [ibid., xvii, p. 249] or Pierce's pea virus 3 [ibid., xvii, p. 90] in its thermal death point, but its longevity *in vitro* considerably exceeds that of the American viruses.

Amtliche Pflanzenschutzbestimmungen. [Official plant protection regulations.]—*Beil. NachrBl. dtsch. PflSchDienst*, x, 7, pp. 208–213, 1938.

LATVIA. Particulars are given of regulations issued on 30th April, 1938, concerning the organization of the Latvian Plant Protection Service; commerce in, and supervision of, plant protectives and automatic spraying or dusting apparatus; inspection of tree nurseries; and control of the import, export, and transport of plants and parts thereof, in which connexion provision is made for the accompaniment of imported potato consignments by certificates vouching for the absence of wart disease (*Synchytrium endobioticum*) from the place of cultivation during the previous ten years [cf. *R.A.M.*, xvi, p. 848].

[Details of regulations published on 30th June, 1938, governing the sale of plant protectives in Latvia are given in *Int. Bull. Pl. Prot.*, xii, 11, pp. 246M–247M, 1938.]

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WALLACE (J. M.) & MURPHY (A. M.). **Studies on the epidemiology of curly top in southern Idaho, with special reference to Sugar Beets and weed hosts of the vector Eutettix tenellus.**—*Tech. Bull. U.S. Dep. Agric.* 624, 46 pp., 5 figs., 1 graph, 1938.

A detailed account is given of studies conducted from 1929 to 1935 on the principal desert host plants of the beet leafhopper (*Eutettix tenellus*) in Idaho, with special reference to their reaction to curly top and their relative importance as a source of supply of the virus [*R.A.M.*, xviii, p. 223].

Tumble mustard (*Norta altissima*) appears to play an insignificant part in the provision of infective material, being extremely difficult to infect and in some way counteracting the multiplication of the virus. In a cage test, only 5 out of 841 beets exposed to leafhoppers from diseased *N. altissima* plants contracted curly top symptoms of a mild order, while field experiments gave negative results. Flixweed (*Sophia parviflora*) is susceptible to curly top, but often requires heavy inoculation at high temperatures before developing conspicuous symptoms; the virus, however, may be obtained from infected plants with no external signs of the disease. Passage through *S. parviflora* usually results in attenuation of the virus, and this host is believed to be responsible for the fact that the virus carried by desert leafhoppers is predominantly of the attenuated type. Green tansy mustard (*S. longipedicellata*) is highly susceptible both to virulent and attenuated strains of curly top, and serves as an important source of supply of infective material in the desert breeding grounds of *E. tenellus*. The curly top virus was recovered from inoculated Russian thistle (*Salsola pestifer*) plants showing no discernible symptoms of the disease. Attenuation sometimes followed passage through this host, autumn populations of the insect on which were largely non-viruliferous, indicating that *S. pestifer* is of less importance in the increase and distribution of the virus under desert conditions than in beet fields.

The viruliferous percentage of spring-brood leafhoppers varied appreciably from year to year (4 to 67 per cent.); at this stage the virus frequently consisted almost exclusively of attenuated strains, but as curly top developed in the beet fields to which the leafhoppers migrated, the latter acquired fresh supplies of virulent material and by harvest time practically 100 per cent. of the insects were viruliferous.

It was conclusively shown by experimental studies that the curly top virus can overwinter in living leafhoppers without undergoing any apparent loss of virulence. It was further found to survive under controlled conditions both in *Sophia parviflora* and *S. longipedicellata,* but the extent to which such perpetuation occurs in nature is not known. Field observations indicated that in some years leafhoppers overwintering in the cultivated areas initiate severe outbreaks of curly top. Under favourable conditions for the establishment of an epidemic sufficiently large leafhopper populations to cause heavy damage will probably reach the beet fields during the dispersal period of the insects. Among the many various factors to be considered from the epidemiological standpoint the one of most importance appears to be the stage of development of the plants at the time of leafhopper infestation. During the past 11 years there were 6 of high and 5 of low yields in the Twin Falls district, the former coinciding with a relatively late leafhopper movement (on or after 4th June) and the latter with an early migration (on or before 24th May). In this connexion the value of early planting in enabling the plants to escape the critical phase of infection is emphasized.

STIRRUP (H. H.). **Yellowing in Sugar Beet.**—*Brit. Sug. Beet Rev.*, xii, 3, pp. 77–80, 1938.

In this article the author surveys the various causes of yellowing of sugar beet [*R.A.M.*, xiv, p. 547] in England. In June and July, 1935, sugar beets received a severe check in many parts of the country owing to 'wilty yellows', which is regarded as a drought effect, a view supported by the recovery of affected plants with the advent of rains.

'Speckled yellows', confined to a few well-defined areas, is due to manganese deficiency. Affected plants have a markedly upright habit, the outer leaves are covered with star-shaped, yellow spots, and the lateral and basal margins of the affected leaves curl inwards, giving the leaves a triangular shape. The young heart leaves may also show these symptoms, but much less conspicuously. In severe attacks, affected fields can be recognized from a considerable distance by the yellowing of the foliage. On a sewage farm, where the sewage was heavily limed before being placed on the land, the P_H value of the soil rose in a few years to 8·4, with the result that mangolds and beets became severely affected with speckled yellows. On soils deficient in available manganese, speckled yellows can be prevented or cured by applying manganese sulphate at the rate of about 100 lb. per acre. In one experiment, an application at half this rate gave an increase in total sugar of 5 cwt. per acre, while one at the rate of 150 lb. per acre gave a corresponding increase of 8·1 cwt., the yield of tops also being increased. It was calculated that an expenditure of 30*s*. per acre on manganese sulphate increased the value of the crop by about £4 per acre.

No authentic case of virus yellows (or 'jaunisse') [ibid., xviii, p. 78] has so far been found in England, in spite of the most careful search.

The most prevalent form of yellowing in England is 'crackly yellows', in the early stages of which large orange or golden-yellow areas appear between the veins on the outer leaves, the leaves becoming thick and brittle, so that they crackle when squeezed in the hand. The dying parts

of the leaves are later invaded by weak parasites, which produce the large, irregular, brown patches of leaf scorch [ibid., xiv, p. 548], though, occasionally, leaves affected with crackly yellows become quite red, this symptom occurring more commonly in mangolds than beets. Unfavourable soil conditions (either too wet or too dry) appear to be an important factor in the causation of crackly yellows, while nitrogen starvation also appears to conduce to it. Observations on numerous experimental plots made over some years suggest that the condition is primarily a manifestation of nitrogen starvation in beets well supplied with other elements. The trouble was in some cases associated with hard pan.

Mosaic is the only virus disease of beet that has been recorded with certainty in England.

Brooks (C.) & McColloch (L.). **Stickiness and spotting of shelled green Lima Beans.**—*Tech. Bull. U.S. Dep. Agric.* 625, 24 pp., 4 figs., 12 graphs, 1938.

Investigations are described into two serious conditions affecting fresh Lima beans [*Phaseolus lunatus*] kept or transported after being shelled, viz., a slimy, sticky condition of the surface, and a superficial spotting consisting of spots 1 to 3 mm. in diameter, with an indefinite margin. The spots are usually brown, but under very humid conditions may become olivaceous. At first only the testa is involved, but later brown spots may form on the cotyledons.

Among the most active organisms isolated from the sticky beans and demonstrated by inoculation tests to be capable of producing stickiness were *Pseudomonas ovalis* from Virginia beans, an organism probably identical with *Achromobacter coadunatum* from California beans, and another resembling *A. lipolyticum* from Florida beans. The superficial spotting was found to be caused by *Cladosporium herbarum*. The causal organisms of both conditions occur in the soil or on decaying vegetable matter and are carried to the beans in the process of shelling.

Both troubles were diminished but not controlled by lowering the humidity of the storage atmosphere. Reducing the storage temperature to 41° F. checked both conditions for six to seven days or more, and this period was increased to 10 to 14 days by a further reduction to 32°. Keeping the beans in an atmosphere containing at least 25 per cent. of carbon dioxide had an inhibiting effect on the stickiness equivalent to that of a reduction in temperature of 18° and an even more marked effect on the spotting, with no adverse effect on flavour. Washing the beans in a 30 per cent. solution of ethyl alcohol or the pods in a 4 per cent. solution of chlorinated lime completely controlled spotting and gave good commercial control of stickiness.

Anliker (J.). **Infektionsversuche an Schnittlauch (Allium schoenoprasum L.) mit Fusarium vasinfectum Atk. var. zonatum (Sherb.) und Fusarium avenaceum (Fr.) Sacc.** [Infection experiments on Chives (*Allium schoenoprasum* L.) with *Fusarium vasinfectum* Atk. var. *zonatum* (Sherb.) and *F. avenaceum* (Fr.) Sacc.]—*Phytopath. Z.*, xi, 4, pp. 439–446, 3 figs., 1938.

Fusarium vasinfectum var. *zonatum* f. 1 [*R.A.M.*, xvi, p. 440] and *F. avenaceum* were isolated from chive plants (also attacked by eelworms)

obtained from a Zürich nursery in 1936. This host has hitherto been regarded as immune from attack by *Fusarium*, and in order to ascertain the cause of the disease inoculation experiments were carried out with the two species isolated. Plots artificially infected with *F. vasinfectum* var. *zonatum* f. 1 yielded an average of 26 per cent. fewer plants than the controls, and caused a reduction in the air-dry weight of about 32 per cent. Plots artificially infected with *F. avenaceum* yielded 50 per cent. fewer plants than the controls, but simultaneous infection with both fungi did not result in greater damage and did not exceed the results obtained with *F. vasinfectum* var. *zonatum* f. 1 alone. Septate and non-septate mycelium was found in the tissue of all parts of numerous infected plants, and the two species of *Fusarium* used for the artificial infections were reisolated.

Sempio (C.). **Sulla maggiore sensibilità di piante infette al momento della sporificazione del parassita (nota preventiva).** [On the greater sensitivity of diseased plants at the time of sporulation of the parasite (preliminary note).]—*Riv. Pat. veg.*, xxviii, 9–10, pp. 393–397, 2 figs., 1938.

In further studies on the influence of environmental factors on infection [*R.A.M.*, xviii, p. 48] the author inoculated 15-day-old Gotta lettuces with an aqueous suspension of the conidia of *Bremia lactucae* [*R.A.M.*, xviii, p. 7], one series of pots being placed in the dark for six days from the commencement of infection, a second treated similarly from the seventh day after inoculation until the end of the ninth day, and a third retained in the light as a control.

Ten or eleven days after inoculation, the controls and the seedlings placed in darkness on the day of inoculation showed the usual symptoms of infection, whereas those placed in darkness on the seventh day showed flaccid, rolled, necrotic leaves. Repeated experiments invariably confirmed this result, and it is concluded that in the disease in question the period preceding the emission of the conidiophores is a highly critical one, in which the host-parasite relationship is definitely and characteristically upset by unfavourable environmental conditions normally exerting no adverse effect. Analogous results were obtained with radish infected with *Cystopus candidus* and Rieti wheat infected with *Erysiphe graminis* [ibid., xviii, p. 166], but the plants placed in darkness on the seventh day showed yellowing without wilting or necrosis.

White (H. L.). **The sterilization of Lettuce seed.**—*Ann. appl. Biol.*, xxv, 4, pp. 767–780, 1 pl., 7 graphs, 1938.

Full details are given of experiments on the sterilization of lettuce seed by calcium hypochlorite (bleaching powder), preliminary accounts of which have been already noticed from other sources [*R.A.M.*, xiii, p. 676; xiv, p. 673]. Preparations of bleaching powder differ considerably in chemical activity, and before sterilizing large quantities of seed a preliminary test should be made of its effect on the germination of a small sample. Preparations containing mercury, such as the organic mercurial dusts, are highly toxic to lettuce seed, the germination of which was stimulated by treatment with calcium hypochlorite.

Cook (M. T.). **Cucumber mosaic in Puerto Rico.**—*J. Agric. P.R.*, xxii, 3, pp. 443–447, 1 pl., 1938.

In histological studies on cucumber mosaic [*R.A.M.*, xvii, p. 299] the author found that in most instances the mosaic leaves and mosaic parts of leaves were thinner than normal leaves and normal parts of leaves. The palisade cells in the mosaic areas were invariably shorter than normal and occasionally they remained undeveloped and cuboidal. The chloroplasts were more numerous and generally larger in the normal than in the mosaic parts. There was little, if any, difference in the size of the palisade cells in the chlorotic and green areas of the fruits, but fewer chloroplasts were noted in the chlorotic cells than in the green areas.

Pizer (N. H.) & Thompson (A. J.). **Investigations into the environment and nutrition of the cultivated Mushroom (Psalliota campestris). II. The effect of calcium and phosphate on growth and productivity.** —*J. agric. Sci.*, xxviii, 4, pp. 604–617, 1938.

In further studies on the environment and nutrition of *Psalliota campestris* [*R.A.M.*, xvii, p. 11], the mushrooms were grown (in houses during summer) in composts made from fresh horse manure and wheat-straw bedding to which was added commercial flake calcium chloride, ground gypsum, superphosphate of lime, and hydrated lime (the last in error for ground carbonate of lime) containing, respectively, 26, 24, 21, and 53 per cent. calcium, the most suitable rate being taken as that providing 0·5 part of calcium per 100 parts of dry compost by weight. All these materials, except hydrated lime, promoted mycelial growth in laboratory trials. To all the composts a soluble phosphate was also added in amounts equivalent to 0·031 gm. of phosphorus per 100 gm. of dry compost. Experiments were laid down so that the effect of superphosphate on yield could be examined statistically; ammonium sulphate was added to some of the plots in addition to superphosphate, as in laboratory tests it had resulted in improved mycelial growth.

The data obtained showed definitely that on some kinds of manure mycelium does not grow properly unless a calcium compound is added. Hydrated lime was found to be markedly deleterious as it makes the compost too alkaline even when used in small amounts. Calcium carbonate was less effective in laboratory experiments than calcium chloride, or sulphate, or acid phosphate. Calcium chloride is one of the best flocculants but may increase the osmotic pressure unduly in composts containing a high proportion of soluble matter. In one experiment in which calcium chloride was used freshly cut mushroom tissue rapidly turned brown, possibly owing to the chloride ion. Superphosphate flocculates manure very readily since it is moderately soluble and the effect of small amounts of superphosphate in lowering the P_H value of the composts was not harmful. The influence of superphosphate on mycelial growth largely results from the action of calcium on the compost and from that of the phosphate ion, which seems to increase the number and thickness of the hyphae. In a majority of the tests superphosphate gave earlier cropping and more numerous buttons; additions of 5 to 9 lb. per ton of fresh manure increased yields, while larger

amounts appeared to reduce them. Growers have reported that the addition of superphosphate sometimes increased the yield, but in others cropping finished earlier and the yield was not so good. In view of these results superphosphate should be employed only to supply phosphate, and not as a flocculating agent. On manure giving unsatisfactory results it is most readily applied mixed with gypsum, 28 lb. of a mixture containing not over 7 lb. of superphosphate replacing the second gypsum application.

Ground gypsum was the most satisfactory flocculating agent tested. It is effective in alkaline and acid conditions, and as its maximum solubility in water is very low, large applications do not affect the osmotic pressure. It supplies sulphate, which may be valuable as a nutrient; it has, apparently, no adverse effect on mushroom metabolism; and it is inexpensive and easily obtained. It invariably gave vigorous growth and normal cropping in all the quantities in which it was used (22·5 to 56 lb. per ton of fresh manure). In practice, 28 lb. per ton of fresh manure is a suitable quantity to apply. It should be applied as early as possible in order to avoid uneven flocculation. Following the recommendation of the first-named author [ibid., xvi, p. 585] gypsum is now widely used by growers, most of whom find it produces more reliable composts, but a few consider it is unnecessary.

The physico-chemical changes resulting from the presence of calcium are of great value during fermentation. The ability of the colloids to take up and hold water is increased, and the flocculated manure has a more rigid, granular structure. Drainage and aeration are improved, and much more water can safely be added without the manure becoming sodden and compacted. Aerobic fermentation is favoured, and the products of anaerobic fermentation appear to be less. With larger amounts of water in the manure and improved aeration, chemical changes occur more quickly, and the manure composts sooner. The final compost is a uniform product of good physical condition free from unpleasant odour.

The value of gypsum appears to be due to changes produced by calcium ions in the physico-chemical condition of the manure, flocculation being the most apparent. Flocculation induced improved aeration, which may be partly the cause of better mycelial growth; in instances of failure remedied by flocculation, however, mycelial growth is no better on the surface of the manure than in it, and sometimes does not take place at all. The new surfaces formed during flocculation may possibly assist reactions on the hyphae or by enzymes secreted by them, for the structure, composition, and energy of surfaces and the rates of diffusion across them play important parts in enzyme reactions.

Storey (H. H.) & Nichols (R. F. W.). **Studies of the mosaic of Cassava.**—*Ann. appl. Biol.*, xxv, 4, pp. 790–806, 2 pl., 1 fig., 1938.

On the basis of studies on cassava mosaic [*R.A.M.*, xvii, p. 724] in plants of a single clone, all grown under identical conditions at Amani, Tanganyika, the authors were able to divide the symptoms into two well-defined groups, produced by the severe and the mild strains of the virus, the former characterized by severe chlorosis with usually large, more or less uniformly distributed, but sometimes localized, yellow or

nearly white chlorotic areas, and the latter, often quite symptomless, characterized by slight chlorosis with small, either generally distributed or localized chlorotic areas, only slightly paler than normal. Transmission of the virus by grafting has been used by the authors for several years as a routine technique with consistent success. Apparently healthy plants have sometimes developed from cuttings from a diseased plant, and occasionally a cutting has produced a healthy plant, while other parts of the same stem from above and below the cutting have produced diseased plants, so that the virus is apparently not always fully systemic. Attempts to transmit the virus by needle scratch and puncture, by rubbing young leaflets, or by hypodermic injections gave negative results; the insects *Erythroneura cassavae* and *Penthimia bella*, bred successfully on cassava, also failed to transmit the virus in a limited series of trials. Both the severe and mild groups of the virus were successfully transmitted by a species of *Bemisia* referred to *B. gossypiperda* by Karam Singh and to *B. nigeriensis* by G. H. Corbett, while a field collection was determined by J. Ghesquière as *B. gossypiperda* var. *mosaicivectura*. It remains doubtful, therefore, whether the virus of cassava mosaic is transmitted by one or several species of *Bemisia*. In transmission experiments, in which large numbers of insects were used, the vector was capable of inoculating the plant successfully only through immature leaves which had reached about one-quarter of their full length. The virus passed from the leaf into the stem about eight days after inoculation, and rapidly advanced to the base of the stem, but only slowly moved into side branches or into other stems arising from the same cutting. A new transmission technique, entailing the enclosure of a quarter-grown single leaf in a glass tube into which the insects are blown from a pipette, was evolved in the course of these experiments and found to be economical and reliable. Infection with a mild strain did not confer immunity from severe strains introduced by grafting, but when the severe strains were inoculated by insects some degree of induced resistance was manifest; field trials, however, showed that this strain does not afford a practical means of protection.

Du Plessis (S. J.). **The occurrence of the dead-arm disease of Vines in South Africa.**—*Sci. Bull. Dep. Agric. S. Afr.* 175, 9 pp., 7 figs., 1938.

In this expanded account of investigations since 1935 into dead arm disease of the vine in South Africa the author states that the perfect stage of the causal organism (*Cryptosporella viticola*) [*R.A.M.*, xvii, p. 499] has not been found locally, while the conidial stage, *Fusicoccum viticolum*, was isolated from lesions on the shoots, and gave positive results in inoculation tests. *F. viticolum* was also found on old, decaying shoots in the vineyard, but it appears to sporulate less abundantly in South Africa than in the United States. Infection seldom leads to the death of the major parts of the vines and of the bunches, owing to the dry conditions prevailing during summer in the winter-rainfall area of Cape Province. It does not appear that the disease is likely to become very serious in South Africa. The Cabernet, Barlinka, and Red Hanepoot vine varieties are only moderately susceptible.

Du Plessis (S. J.). **Further studies on the control of Botrytis rot in Grapes.**—*Sci. Bull. Dep. Agric. S. Afr.* 166, 9 pp., 7 figs., 1938.

This is an expanded account of work already noticed from another source [*R.A.M.*, xvii, p. 499]. Infection by *Botrytis cinerea* was more severe in unwrapped than in wrapped grapes, in grapes packed in a slanting position than in those packed flat, and in grapes packed with corrugated paper linings to the boxes than in those packed with wood wool.

Vasiliu (H.), Huber (Z.), Pântea (C.), & Timoşencu (A.). **The presence of copper in the soil of vineyards, its influence, and the influence of copper in general on plant growth. The influence of copper on plant development.**—*Bul. Fac. Şti. agric. Chişinău, Comun. Lab. Chim. agric.*, i, 3, pp. 49–61, 1937; ii, 1, pp. 71–76, 1938. [Rumanian. Abs. in *Chem. Abstr.*, xxxii, 22, p. 9366, 1938.]

Considerable amounts of copper are stated to accumulate in the soil of Rumanian vineyards as a result of spraying [against *Plasmopara viticola*: cf. *R.A.M.*, xiv, p. 244], and analyses showed that a portion is absorbed by the plants growing in the vicinity. Lundegårdh's method [ibid., iv, p. 104] was used to determine the effect of the metal on plant growth, especially spring wheat and maize, which were found to benefit by small quantities of copper, whereas large amounts produced a toxic effect. In a further series of experiments with maize the addition of ammonium sulphate to soil treated with various amounts of copper sulphate was found to increase the dry substance of the plants by up to 50 per cent., whereas without the ammonium sulphate the copper exerted no influence whatever, since enough was already in the soil to suffice for the smaller development of the plants.

1er Congrès des Microbiologistes de langue française (Paris, 27, 28 et 29 octobre 1938). [First Congress of French-speaking microbiologists (Paris, 27th, 28th, and 29th October, 1938).]—*Ann. Inst. Pasteur*, lxi, 6, pp. 756–882, 1938.

Among the papers contributed to the first congress of French-speaking microbiologists held in Paris from 27th to 29th October, 1938, the following contain references to matters of phytopathological interest.

W. H. Schopfer briefly discusses (pp. 779–780) the phenomenon of symbiosis in relation to growth-promoting factors, as exemplified by the joint development in a synthetic culture medium (insufficient for either alone) of *Rhodotorula rubra* and *Mucor ramannianus*, each of which supplies the other with the requisite elements [cf. *R.A.M.*, xviii, p. 198]. A second short paper (pp. 781–782) by the same author treats of the specific action of aneurin [vitamin B_1] and a homologue of this substance on various fungi, including *Ustilago violacea* [ibid., xviii, p. 185].

S. Métalnikov summarizes (pp. 826–827) the successful results of his experiments in the control of various crop pests by means of the application of dried bacterial spore emulsions, with special reference to work conducted along these lines in 1937 against vine insects in France [ibid., xvii, p. 35].

J. Comandon and P. de Fonbrune give some further details (pp. 842–844) of the mechanism of the various kinds of 'traps' and 'snares' elaborated by nematode-destroying fungi [see below, p. 251].

A. Gratia sums up (pp. 845–852) the results of recent outstanding contributions to the problem of ultramicroscopic viruses.

P. Manil draws attention (pp. 858–860) to the extreme heterogeneity in respect of various important characters (thermal death point, dilution tolerance, reaction to antiseptics, and antigenic properties) of a number of plant viruses.

J. Dufrénoy briefly describes (pp. 876–878) an experiment in which virus Y-free stocks of Up-to-Date and Arran Banner potatoes from Eire, cultivated in a mountain reserve of the French Pyrenees in proximity to infected indigenous varieties and consequently visited by *Myzus persicae*, contracted the typical perivascular necroses caused by this virus, whereas similar material grown in an isolated field remained healthy. The average weights (in gm.) of the tubers produced per plant by Up-to-Date were as follows: isolated site and three infested fields, 1,018, 825, 577, and 615, respectively, the corresponding figures for Arran Banner being 673, 554, 489, and 436, and for the indigenous varieties 745, 715, 715, and 646, respectively [cf. ibid., xvii, p. 833].

Narasimhan (M. J.). **Annual report of the Mycological Department for the year 1936–37.**—*Adm. Rep. agric. Dep. Mysore, 1936–37*, pp. 169–173, 1938.

The following are among the items of interest in this report [cf. *R.A.M.*, xvi, p. 154]. Koleroga disease (*Phytophthora arecae*) of areca nut was virulent, especially in the Thirthahalli district, as the heavy monsoon throughout the year did not permit spraying. Gardeners round Yedur who closely followed the spraying recommendations of the Department and finished spraying before the beginning of the monsoon, and sprayed a second time when the nuts were well developed, made their crops absolutely safe, whereas a number of others, who postponed spraying, lost the major portion of their crops, since there was no break in the monsoon to allow of treatment.

A fungus resembling *Cephalosporium* [ibid., xviii, p. 89] was isolated from the root-stocks of cardamom [*Amomum subulatum*] from a garden at Uchangi, the same fungus as has been reported to be associated with the so-called 'phurki' disease [loc. cit.] of the greater cardamom [*Elletaria cardamomum*] in the Darjeeling district in India, although even there its pathogenic nature has not been proved. The 'katte roga' disease of cardamom, causing on the leaves streaks or stripes, which later fuse together, was studied on a number of estates, where different kinds of leaf spots and mosaic were also observed.

Pure cultures of *Pestalozzia psidii* and a *Gloeosporium* [ibid., iii, p. 701] were obtained from isolations from the diseased fruits of guava [*Psidium guajava*] showing the characteristic spots. Inoculations of wounded or unwounded unripe fruits with spores of the two fungi were unsuccessful. Spraying guava trees at Hebbal with 1 per cent. Bordeaux at an advanced stage of infection failed to control *P. psidii*, whereas the same spray in a garden near Bangalore at an early stage of infection was very effective.

The perfect stage of *Sclerotium rolfsii* causing the pseudostem rot of plantains was obtained on onion agar in Petri dishes and test-tubes in about two months.

A species of *Colletotrichum* [cf. ibid., xiv, p. 718] isolated from betel vines [*Piper betle*] affected with the 'karijali roga' disease developed perithecia in culture. This disease is characterized by blackish spots on the leaves and vines, the latter drying up with the withering of the foliage and even collapsing in cases of severe infection.

About 100 lime trees attacked by *Pseudomonas citri* [ibid., xiii, p. 160; xvii, p. 520] at Gunjur were effectively protected by 1 per cent. Bordeaux.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, xlix, 12, pp. 669–673, 5 figs., 1938.

To secure control of tomato bacterial canker (*Aplanobacter michiganense*) [*R.A.M.*, xvii, p. 376] in New South Wales, growers are advised to obtain their seed only from crops completely free from canker and *Fusarium* wilt [*F. bulbigenum* var. *lycopersici*: ibid., xvii, p. 588]. In addition, the seed should be extracted by fermentation with the pulp, without water, for not less than three days, and should be disinfected with mercuric chloride (1 oz. per 6¼ gals. water). The position of the seed-beds should be changed annually, and the soil treated with formalin. Infested land should not be planted to tomatoes for three years; in glasshouses steam sterilization should be used.

To secure adequate control of passion fruit [*Passiflora edulis*] brown spot (*Alternaria* [*passiflorae*: ibid., xvii, p. 695]), the vines should be pruned at least once a year, and sprayed with Bordeaux mixture (6–4–50) at intervals of about a month during spring and summer and of two months during the remainder of the year. The spray must reach the inner portions of the vines.

In seed treatment against China aster [*Callistephus chinensis*] wilt (*Fusarium conglutinans* [var.] *callistephi*) [ibid., xvii, p. 297] the best results are given by pre-soaking in water for 30 minutes, followed by immersion for the same period in mercuric chloride (1 oz. to 6¼ gals. water); after this, the seed is washed for 5 minutes in running water, drained, and spread out to dry for 24 hours.

The best precaution against cabbage downy mildew (*Peronospora parasitica*) is to spray the plants in the seed-bed with Bordeaux mixture (1–1–10) plus a spreader or sticker, directly the first leaves begin to develop and then weekly until the plants are set in the field. All spotted heads should be rejected at harvesting. In addition, crop rotation is necessary, and the plants must not be grown too thickly or kept too wet in the seed bed.

Twelfth Annual Report of the Department of Scientific and Industrial Research, New Zealand, 1937–38.—128 pp., 1938.

G. H. Cunningham, on pp. 21–23 of this report, states that investigations of the Plant Diseases Division have demonstrated that *Phoma lingam* [*R.A.M.*, xviii, p. 222] may persist in infected soil for two seasons. Soft rot disease of swedes and turnips was found to be due to *Bacillus* [*Pseudomonas*] *campestris* [ibid., xvii, p. 29] and *B.* [*Erwinia*] *melonis* [ibid., xi, p. 344], entry being effected through injuries, generally leaf scars, and facilitated by animal injuries or previous attack by virus disease. Wart cress (*Cardamine heterophylla*) and wallflower were found to be additional hosts of turnip mosaic [ibid., xviii, p. 223].

Halo blight of oats (*Bacterium coronafaciens*) [ibid., xvi, p. 310] occurred in two localities.

Mosaic of runner and dwarf beans [*Phaseolus vulgaris*] was due, apparently, to bean virus 1, 30 per cent. of the seed from mosaic plants being affected [ibid., xvi, p. 295; and see below, p. 288]. Of 33 garden and 10 field varieties of peas, 11 and 1, respectively, were immune from mosaic (pea virus 2) [ibid., xvii, p. 126].

A disease of field and glasshouse tomatoes previously confused with *Verticillium* wilt [*V. albo-atrum*] was caused by *Aplanobacter michiganense*. The host range of tomato spotted wilt in New Zealand [ibid., xvi, p. 714] was extended to include 21 species in 7 families; lettuces were seriously affected in one locality.

Passion fruit [*Passiflora edulis*] grease spot was caused by an organism which is stated to have been named *Phytomonas passiflorae*, and brown spot of the same host by *Alternaria passiflorae* [see preceding abstract].

The tobacco mosaic virus (tobacco virus 1), which may be spread by smokers to plants in the field, was destroyed in smoking tobacco without impairment of flavour by autoclaving for 15 minutes at 10 lb. pressure.

In the sections of this report dealing with fruit research and cold storage (pp. 40–49) it is stated that the application of Bordeaux mixture (1½–3–50) early in January, before any sign of infection had appeared, gave satisfactory control of bitter rot of apples (*Glomerella cingulata*).

A scheme for the certification of fungicides, inaugurated and controlled by the Plant Diseases Division, is now in operation, and two certification lists covering orchard sprays have been issued.

When Cox's Orange Pippin apples were taken from sunny and well-shaded parts of the trees (two pickings being made), on arrival in London storage pit was practically the only form of wastage found. The condition increased appreciably during the three weeks following discharge, while much breakdown and some fungal infection developed in the second picking. In both shipments pit was much more severe in the fruit from the shaded than in that from the sunny parts of the trees; it was less severe in the second than the first picking.

Experimental evidence showed that the use of oiled wrappers did not improve the keeping quality or general appearance of Cox's Orange Pippin, Jonathan, Dunn's Favourite, Wolseley, Ballarat, Statesman, Sturmer Pippin, Delicious, or Dougherty apples, but did reduce superficial scald in Granny Smith and Rome Beauty apples. Further storage trials with Granny Smith apples also showed that the locality of the orchard is a significant factor in the development of superficial scald, that the less mature fruit becomes affected earlier than the more mature, and that fruit cooled almost immediately after picking develops more discoloration than fruit whose storage is delayed.

After two months' storage, Cox's Orange Pippin apples from trees receiving ammonium sulphate developed a high percentage of internal breakdown, as compared with fruit from untreated trees or trees given phosphate-potash applications. The use of phosphate and potash in addition to the nitrogen halved the incidence of breakdown. None of the treatments had any effect on storage pit. The increase in susceptibility to breakdown induced in Dunn's Favourite apples by applications

of 2 or 4 lb. of ammonium sulphate per tree in time became less, though still apparent. With Jonathan apples, applications of 2 and 4 lb. ammonium sulphate in addition to normal phosphate and potash continued to give marked and proportionate increases in susceptibility to breakdown and fungal infection. Jonathan spot was unaffected by nitrogen treatments. Potash reduced breakdown and fungal incidence, but markedly increased Jonathan spot and induced a slight amount of deep scald. On the Sturmer variety nitrogen by itself gave a relatively high percentage of breakdown and fungal disease, this adverse effect being, however, reduced by the use of phosphate in addition to the nitrogen, while phosphate plus potash eliminated it completely. Potash applied at various rates reduced breakdown and fungal infection in Sturmers, but storage pit was unaffected by different treatments.

Division of Plant Pathology.—*Rep. N.Y. St. agric. Exp. Sta., 1937–38*, pp. 22–24, 1938.

Evidence obtained in New York State has shown that in the control of apple scab [*Venturia inaequalis*: *R.A.M.*, xvii, p. 118] lime-sulphur should be employed only as an eradicant, while for preventive purposes wettable sulphurs are equally effective. Bordeaux mixture and its substitutes should have no part in the spray programme except as summer or cover sprays. Orthex is highly valuable when used with sulphurs that it flocculates, since it enables the spray to be applied during rain, and allows the concentration of the fungicide to be materially reduced. The carry-over of infection in badly diseased orchards may be practically eliminated by applications of liquid fertilizers in early spring.

Flotation sulphur with orthex gave better results against cherry leaf spot [*Coccomyces hiemalis*: see below, p. 261] than lime-sulphur; wettable sulphurs did not give adequate control. Bordeaux mixture should be used against this disease after picking.

Eradication methods, as used in western New York, against raspberry mosaic, appear to be unavailing in the Hudson Valley. In resistance tests the Marcy, Indian Summer, and 20 seedling red raspberry varieties have remained free from the disease in experimental plantings [ibid., xvii, p. 377].

The seed treatment of peas with red copper oxide continues to increase, 110,000 bushels being treated in 1938. Evidence was obtained that the material may cause injury if fertilizer is sown with the peas; it should not be used when the seed is to be planted in acid soils. Spraying with red copper oxide against damping-off of peas should be carried out before transplanting.

Hop downy mildew [*Pseudoperonospora humuli*] was effectively controlled by Bordeaux mixture (4–2–50); the spray increased the yield by from 30 to 100 per cent., and gave more mature hops of better quality. Selection of healthy propagating material controlled hop 'slip down' [ibid., xvii, p. 377].

Higgins (B. B.). **Botany.**—*Rep. Ga agric. Exp. Sta., 1937–38*, pp. 54–62, 3 figs., 1938.

Spanish groundnuts growing in Georgia, and treated by sulphur-dusting against leaf spot (*Mycosphaerella arachidicola* and *M. berkeleyii*)

[*R.A.M.*, xvii, p. 651] retained their leaves up to maturity and gave an increase in yield of 5 to 77 per cent. (average 18 per cent.) over the undusted controls; not all the increased yield was, however, attributable to disease control.

Mycosphaerella pinodes and *Ascochyta pinodella* [ibid., xvi, p. 435; xvii, p. 645] were isolated from fragments of Austrian Winter pea stems found in the field in September, showing that these fungi can live over from spring until autumn in old, diseased stems left on the ground, and so provide inoculum for the new crop sown in autumn. In one test, *A. pinodella* was isolated from old, dry pea stems kept in the laboratory for 13 months. Preliminary tests indicated that rotation is at present the most promising means of controlling pea leaf blotch (*Septoria pisi*) [ibid., xi, p. 222].

Report of the Michigan Agricultural Experiment Station for the two years ended June 30, 1938.—48 pp., 1938.

This report [cf. *R.A.M.*, xvi, p. 157] contains the following items of phytopathological interest. In field trials with several copper compounds (oxobordo 3–50, coposil 2–50, copper hydro 40 4–50, cupro 3–50, basicop 4–50 [ibid., xvii, p. 608], high calcium lime Bordeaux, magnesium lime Bordeaux, and calcium and magnesium limes alone) in the control of early blight of potatoes [*Alternaria solani*: ibid., xvii, p. 836], only the two Bordeaux mixtures were effective, showing 8·3 and 10·1 per cent. of infection, respectively, and reducing leafhopper injury from 98 per cent. in the untreated control to 5 per cent. The other copper compounds only reduced infection from 55 to 21 per cent. below that of the control.

In field tests of the reaction of tomato varieties to wilt [*Fusarium bulbigenum* var. *lycopersici*: ibid., xvii, p. 419] the varieties New York State, John Baer, Prairiana, Rutgers, Penn State, Illinois Baltimore, Illinois Pride, Early Baltimore, Michigan State Forcing, Kanora, Marglobe, and Pritchard showed 86, 82, 71, 67, 61, 61, 52, 33, 22, 19, 0, and 9 per cent. infection, respectively. In field and greenhouse trials strains of some of these varieties showed striking differences in their susceptibility to wilt; thus, while John Baer showed 82 per cent., one of the Station's selections of the same variety showed only 19 per cent. infection.

FAWCETT (G. L.). **Departamento de Botánica y Fitopatología.** *Ex* **Memoria anual del año 1937.** [Department of Botany and Phytopathology. *Ex* Annual Report for the year 1937.]—*Rev. industr. agríc. Tucumán*, xxviii, 1–3, pp. 45–48, 1938.

The following are among the references of phytopathological interest in this report [cf. *R.A.M.*, xiii, p. 685]. Red rot of sugar-cane [*Colletotrichum falcatum*] was not detected in any of the samples examined during 1937. The same crop suffers from two forms of chlorosis, one confined to young cane during the spring and curable by applications of ammonium sulphate to the soil, and the other of obscure origin. persisting much longer and not amenable to control by manurial treatment. Experiments have shown that the latter disorder is in all

probability non-infectious [cf. ibid., xii, p. 10], and it also does not appear to be due, under Argentine conditions, to excess of sodium carbonate, as suggested by Tempany in the West Indies (*W. Ind. Bull.*, p. 149, 1917).

Melanosis of citrus [*Diaporthe citri*: ibid., xvii, p. 595] was observed for the first time in Tucumán, chiefly affecting grapefruit.

Curly top is prevalent among sugar and fodder beets, which are also affected by a more serious disease, presumably of virus origin, characterized by the sudden abnormal growth of all the basal leaf buds and resulting in the death of the plants during the spring.

VERONA (O.) & PAGANINI (M. L.). **Influenza esercitata da alcuni ormoni animali sopra lo sviluppo generale di piantine di Ricino e la formazione di tumori sperimentali da 'Bacterium tumefaciens' S. et T.** [The influence exerted by some animal hormones on the general development of Castor Oil plants and the formation of experimental tumours by *Bacterium tumefaciens* S. & T.]—*Arch. Ist. biochim. ital.*, x, 3, pp. 319–324, 1938. [Spanish, Portuguese, German, English, and French summaries.]

A tabulated account is given of the writers' experiments at the Pisa Phytopathological Institute on the action of various animal hormones on the growth of castor oil (*Ricinus*) [*communis*] plants and the development thereon of crown gall (*Bacterium tumefaciens*) tumours [*R.A.M.*, xvii, p. 661]. Thyroid, suprarenal, pituitary, and ovarian follicle extracts were introduced into the seedlings shortly after germination, and inoculation with *Bact. tumefaciens* followed when the first leaf was produced. The treatment noticeably retarded the growth of the plants but did not appreciably affect the development of the tumours.

MONTEMARTINI (L.). **Il Bacterium tumefaciens.** [*Bacterium tumefaciens.*] —*Boll. Ist. sieroter. Milano*, xviii, pp. 551–588, 1938. [Abs. in *Ber. wiss. Biol.*, xlix, 4–5, p. 277, 1939.]

This is stated to be a detailed account of all previous observations, interpretations, and records of *Bacterium tumefaciens*, and is furnished with a bibliography of some 500 entries. The identification and properties of the organism are discussed, the symptoms produced on its hosts described, and lists given of susceptible and resistant plants. The geographical distribution of the pathogen is traced and the results of experiments on its control presented. A comparative study of the literature on plants and animal tumours leads to the rejection of the theory of a parallel between crown gall and cancer [*R.A.M.*, xvii, p. 163 *et passim*].

MAGROU (J.). **Nouvelles observations sur l'immunité humorale chez les plantes.** [Further observations on humoral immunity in plants.]—*Rev. Path. vég.*, xxv, 3, pp. 181–189, 1938.

This is a condensed account of the experiments on humoral immunity from *Bacterium tumefaciens* in plants, which were described and discussed at length in a recent communication [*R.A.M.*, xvii, p. 799].

Waterhouse (W. L.). **Presidential address. Part I. General. Part II. Some aspects of problems in breeding for rust resistance in cereals.**—*J. roy. Soc. N.S.W.*, lxxii, pp. 1–54, 1938.

In the second part of this address the author discusses in some detail different aspects of the breeding of cereals for rust resistance. Tables are given showing varietal resistance to the different physiologic races of these fungi so far identified in Australia and New Zealand. Of the nine races of wheat stem rust (*Puccinia graminis tritici*) found on material from these two countries, three, viz., 43, 44, and 54, are similar, as are three others, viz., 45, 46, and 55; both groups differ widely from each other and from the remaining races 11, 34, and 59. Six races of oats stem rust have been found in Australia, viz., 1, 2, 3, 6, 7, and 8. A complex of 1 with or without 2 is most prevalent; a complex of 3 with or without 7 does not, as a rule, appear early in the rust season, and characteristically attacks the 'side' oats, most of which mature late. Races 6 and 8 are rare. Five races of oat leaf rust (*P. coronata avenae*) [*P. lolii*] have been identified in Australia, viz., 3, 6, 7, 40, and 47. Isolates of barley leaf rust (*P. anomala*) showed no difference in specialization, except in one case, which produced the resistant '2' reaction on Kinner barley.

Thiel (A. F.). **The overwintering of urediniospores of Puccinia graminis tritici in North Carolina.**—*J. Elisha Mitchell sci. Soc.*, liv, 2, pp. 247–255, 3 graphs, 2 maps, 1938.

The results of germination tests of uredospores of stem [black] rust of wheat (*Puccinia graminis tritici*) from 1935 to 1938 in North Carolina showed a high percentage (85 to 95) of viability during October, followed by a sharp drop in November (40 to 75 per cent.) and subsequent months to nil in February. Weather conditions favoured fresh uredospore infections during three different periods in October of each year and in the first week of November in 1935 and 1936, following which new sori were found on wheat. In November, 1937, the requisite conditions were absent and no fresh uredosori were formed. Circumstantial evidence denotes that the primary inoculum in North Carolina does not arise from overwintering uredospores in the State but originates with the northward migration of uredospores from neighbouring south-westerly States where they overwinter.

Mercurial dusts and seed germination.—*Fertil. Feed. St. J.*, xxiii, 24, pp. 627, 629, 1938.

Information regarding the progress of investigations initiated at the Official Seed Testing Station, Cambridge, on the effect of mercurial dusts on seed germination was recently supplied by C. C. Brett at a conference of seed analysts. The abnormal germination of cereal seed-grain sometimes following the use of these preparations may be due to 'over-dressing'. Seed in a healthy condition and of normal moisture content does not usually retain on its surface more than $2\frac{1}{2}$ to 3 times the recommended fungicidal dosage, and the marked phytocidal effect of mercury treatment occasionally encountered may therefore be generally attributed to an undue amount of moisture on or in the seed (chiefly the former) or unsuitable storage conditions. With proper

precautions in these respects there should be very little loss of germinative capacity even in seed-grain stored for periods up to two years.

In the course of the ensuing discussion it was mentioned that wheat appears to be slightly more susceptible to the ill effects of 'over-dressing' than oats or barley. Treated mangold seed in one instance showed a higher percentage of germination after $4\frac{1}{2}$ years than the controls. The application of mercurial preparations to turnips and swedes at the customary cereal doses had little injurious effect in greenhouse tests at Cambridge: one manufacturer, however, suggests the admixture with the dressing of a small quantity of whiting to secure an appropriate dilution for application to minute seeds.

MULDER (E. G.). **Over de beteekenis van koper voor de groei van planten en micro-organismen, in het bijzonder een onderzoek naar de oorzaak der ontginningsziekte.** [On the importance of copper for the growth of plants and micro-organisms, with special reference to a study of the cause of reclamation disease.]—*Landbouwk. Tijdschr., Wageningen*, 1, 618, pp. 898–902, 1938.

Of the plants examined by the writer in water and quartz sand cultures, the most susceptible to reclamation disease induced by copper deficiency [*R.A.M.*, xviii, p. 163] were canary seed [*Phalaris canariensis*] and wheat, followed by barley, oats, and peas, while rye and potatoes were not appreciably affected [ibid., xvii, p. 386]. Soil analyses by Neubauer's method showed that the more defective the soil, the smaller were the quantities of copper assimilated by the plants. Estimation of copper by the *Aspergillus niger* spore method [see next abstract] showed that severely 'diseased' soils contained less than 0·4 γ [$\gamma = 0{\cdot}001$ mg.] copper per gm. dry material compared with 2·5 γ or more in 'healthy' soils and 0·8 to 1·3 γ in those of intermediate condition. There was less than 1 mg. copper per kg. dry substance in the seed of diseased plants as against considerably larger amounts (up to more than 5 mg.) in that of healthy ones.

Field observations in Holland showed that in some cases the actual copper content of the soil is not inadequate, but the element is rendered unavailable either by the nature of the soil, e.g., in marshes, or by the occurrence therein of certain copper-fixing micro-organisms, such as *Bacillus putrificus*, *B.* [*Bacterium*] *coli*, and *Vibrio desulfuricans*. The deficiency of available copper may be remedied by the application to the soil of ammonium sulphate, appropriate cultural operations and green manuring, and seed treatment with 0·3 per cent. copper sulphate.

Magnesium deficiency [formerly known as 'soil acidity'] disease of oats [ibid., xvii, p. 386] is frequently observed in fields suffering from copper shortage, where wheat is also attacked with particular severity by *Septoria nodorum* [ibid., vii, p. 766] and another unidentified fungus producing blackish-brown stripes or spots on the straw and oblong, blackish-brown lesions on the uppermost parts of the haulms. Another phenomenon connected with copper deficiency is the 'licking' disease of cattle fed on hay or grass from affected fields.

Besides *A. niger* [ibid., xvi, p. 199], *A. flavus* and *Penicillium glaucum* were also found to need small quantities of copper (irreplaceable by other elements) for their normal development. Various transformations

induced by copper in micro-organisms indicate that the mineral probably functions as an oxidation catalysator in biological processes.

MULDER (E. G.). **Sur l'influence du cuivre sur la croissance des micro-organismes.** [On the influence of copper on the growth of micro-organisms.]—*Ann. Ferment.*, N.S., iv, 9, pp. 513–533, 4 figs., 1 graph, 1938.

Further details are given of the author's method of determining the copper content of Dutch soils, in relation to the probability or otherwise of the development of reclamation disease in white oats, barley, and wheat, by the growth of *Aspergillus niger* in a synthetic culture solution devoid of copper and supplemented by 1 gm. per 40 cc. of the soil samples to be tested [see preceding abstract]. A black coloration of the spores denotes a healthy soil ($2\frac{1}{2}$ γ assimilable copper per gm. of dry soil), while a yellow, brownish-yellow, or brown tint, corresponding to 0·2, 0·4, and 1 γ, respectively, indicates a greater or less deficiency of the necessary element. These results were confirmed by a series of tests on wheat and oats by Neubauer's method (*Handb. PflErnähr. DüngLehre*, i, p. 882, 1931), involving the culture of the plants in glass cylinders and the estimation of the copper content of the ash. It was found that the addition to sandy soils of copper sulphate at doses corresponding to a rate of 50 kg. per hect. sufficed to release adequate quantities of copper in an assimilable form to maintain the plants in normal health. Peat soils, however, in which practically the entire original and added copper contents are fixed by certain micro-organisms [see preceding abstract], will need larger quantities and frequent applications to produce a comparable improvement.

VISSER (W. C.). **Opmerkingen betreffende een geval van halmdoodervoetziekte bij Tarwe op een stikstofhoeveelheden-proefveld op zandgrond.** [Observations on a case of straw-breaker foot rot of Wheat on a nitrogen dosage test plot on sandy soil.]—*Tijdschr. PlZiekt.*, xliv, 6, pp. 280–288, 1938.

By means of an analytical method based on pore volume determinations (*Soil Sci.*, xliv, pp. 467–479, 1937) the writer drew the following conclusions as to the correlation between soil structure and the incidence of foot rot (*Ophiobolus graminis*) [*R.A.M.*, xviii, pp. 98, 171] in Juliana wheat on a nitrogen dosage trial plot on sandy soil at Groningen, Holland, in 1937. Contrary to the accepted theory, there was a lower incidence of infection on the plots receiving liberal supplies of nitrogen (60 to 120 kg. per hect.) than on those receiving smaller quantities, the former treatment evidently tending to maintain the soil structure in a relatively compact condition, judged by the comparative numbers of narrow, medium-sized, and large pores, while the latter promoted its disintegration. Another factor contributing to the good health of the plants in the heavy nitrogen plots was their luxuriant growth, affording adequate protection against sun and rain.

Summing up the influence of the various environmental conditions on foot rot, severe attacks in the later stages of growth may be anticipated whenever the soil-water-air relationship deviates in an unfavourable direction from the ratio 50:20:30.

NIEMEYER. **Prüfung einer Heisswasseranlage.** [The testing of a hot-water steeping apparatus.]—*Tech. in d. Landw.*, xix, 12, pp. 88–89, 1938.

Particulars are given of the construction and application of a new two-vat, electrically heated apparatus for the continuous hot-water treatment of barley seed-grain against loose smut [*Ustilago nuda*: *R.A.M.*, xvii, p. 594 *et passim*]. In trials at the Biological Institute, Dahlem, Berlin, the outfit (supplied by J. Reuters, Marientaler Str. 84[I], Hamburg 23) gave generally satisfactory results when the seed-grain was enclosed in muslin bags and immersed for two hours in 0·1 per cent. ceresan at an average temperature of 47·4° or 47·6° C., the percentage of emergence in the field ranging from 83·3 to 92·6 compared with a maximum of 98·2 in the untreated controls. With reasonable precautions and certain constructional improvements the apparatus may be recommended as effective for the purpose in view.

ROSEN (H. R.) & WEETMAN (L. M.). **The 1938 crown rust epidemic of Oats in Arkansas in relation to hybrids of Bond and Victoria.**—*Phytopathology*, xxviii, 12, pp. 898–901, 1 fig., 1938.

An apparently new race of crown rust of oats (*Puccinia coronata avenae*) [*P. lolii*: see next abstract], to be designated 45 and attacking Bond and its hybrids, was reported by M. B. Moore and collaborators from Minnesota and Texas in 1937, when an apparently identical race was also discovered by the present writers in Arkansas, which caused a type 4 reaction in inoculation tests on all the differential varieties used (including Bond), except Glabrota, which yielded an I[mmune] response, and Victoria, the latter proving slightly more susceptible than to most collections of race 1. The new race was subsequently isolated in duplicate from 25 out of 153 collections. In greenhouse inoculation tests race 45 was far more aggressive than race 1; the Bond hybrids rapidly developed abundant and severe infection by the new race, but notwithstanding these discouraging results they displayed a very fair degree of resistance in the field. All Victoria hybrids suffered severely from crown rust under field conditions. The potential importance of the new race in relation to the rust resistance breeding programme is briefly discussed.

STANTON (T. R.), MURPHY (H. C.), COFFMAN (F. A.), BURNETT (L. C.), & HUMPHREY (H. B.). **New disease-resistant early Oats from a Victoria-Richland cross.**—*J. Amer. Soc. Agron.*, xxx, 12, pp. 998–1009, 1938.

Very promising results, both as regards productivity and resistance to stem [black] and crown rust [*Puccinia graminis* and *P. lolii*: see preceding abstract] and loose and covered smuts (*Ustilago avenae* and *U. levis* [*U. kolleri*]) [*R.A.M.*, xviii, p. 99 and next abstract], have been obtained in Iowa in crosses between the highly resistant Uruguayan variety Victoria and the early maturing commercial Richland (resistant to black rust only). One or more of the selections will probably be available for distribution to Corn Belt farmers within the next few years.

TAYLOR (J. W.) & COFFMAN (F. A.). **Effects of vernalization on certain varieties of Oats.**—*J. Amer. Soc. Agron.*, xxx, 12, pp. 1010–1019, 1 fig., 1 map, 1938.

The incidence of loose and covered smuts of oats (*Ustilago avenae* and *U. levis.* [*U. kolleri*]) [see preceding abstract] was much reduced at the Arlington Experiment Farm, Virginia, from 1933 to 1937, by the process of vernalization [cf. *R.A.M.*, xv, p. 785], involving 18 to 24 hours' soaking of the seed-grain in cotton bags in tap water at a temperature of 60° to 65° F. and 28 to 45 days' storage at 32° to 34°. In the three years in which smut occurred, there was only one diseased panicle in the vernalized rows of Iogold compared with an average of 4·6 per cent. per row for the untreated, the corresponding figures for winter Lee, Fulghum (C.I. 708), winter Fulghum, and Frazier being 1·3 and 8·4, 0·4 and 9·5, 0·4 and 4·1, and 0·2 and 7·7, respectively, the total averages for the vernalized and control rows of all varieties amounting to 0·5 and 6·3 per cent., respectively.

BRANDWEIN (P. F.). **The emergence of smut-inoculated Oat seedlings through sand and loam soil.**—*Bull. Torrey bot. Cl.*, lxv, 7, pp. 477–483, 1 fig., 1938.

Continuing his studies on the oat smuts [*R.A.M.*, xvii, p. 234], the author gives a brief account of experiments, the results of which showed that when seeds of Monarch and Markton oats, inoculated with a strain of *Ustilago levis* [*U. kolleri*] to which the first is very susceptible and the second highly resistant, were sown in a loam soil or in sand subjected to light tamping, their percentage emergence differed only slightly, if at all, from that of the uninoculated controls. When, however, the seeds of both varieties were sown in the field, the emergence of Markton was reduced by 6·7 per cent. and that of Monarch by 10·7 per cent. in the inoculated as against the uninoculated seeds. Following this result, a further experiment was made, in which single seeds of either variety were each sown in a vial with sand subjected to slight or severe tamping, with the result that in the latter series the emergence of Monarch was reduced from 95 to 75 and that of Markton from 100 to 85 per cent., while in the first series the emergence was 100 per cent. throughout. Examination of the seedlings in tightly packed sand showed a smaller size and lower germination of the inoculated plants as compared with the uninoculated controls. It is suggested that the failure of the plants to penetrate heavily tamped soil may be due to the coleoptile infection [loc. cit. and ibid., x, p. 722; xvii, p. 235] in the inoculated resistant and susceptible oat varieties.

Pathology and mycology of Corn.—*Rep. Ia agric. Exp. Sta., 1937–38*, Part ii, pp. 51–59, 1938.

In studies by I. E. Melhus and G. N. Davis, infection of maize by *Ustilago zeae* [*R.A.M.*, xvii, p. 670] did not take place at wounded surfaces, but at the growing points of the plants, demonstrating that meristematic tissue is necessary for infection.

I. E. Melhus, in further investigations on the *Diplodia zeae* inhibitor [loc. cit.], found that slight growth occurred when the filtrate from an old culture of *D. zeae* on Czapek's medium containing dextrose was

concentrated to one-third, one-fifth, or one-tenth of its normal volume, and 20 c.c. tested against the fungus in the usual way. These concentrated solutions, unlike the normal filtrates, inhibited the organism as strongly at 26° as at 16° C. The inhibition was not destroyed by boiling with trichloracetic acid for one hour. A water extract from maize meal from ears heavily infected with *D. zeae* induced strong inhibition. The inhibitor was not formed in 50 days in cultures in 2 per cent. dextrose solution or on media in which an ammonium salt, asparagin, or leucine was used as the source of nitrogen.

C. S. Reddy states that infection of serial plantings of maize by *Basisporium gallarum* [*Nigrospora* spp.: loc. cit.] was heaviest in the very late plantings. In general, the amount of infection was correlated with cob reaction, but not with water-soluble material in the cobs.

G. N. Davis, C. S. Reddy, I. E. Melhus, W. E. Loomis, E. W. Lindstrom, and A. A. Bryan, in their studies on disease resistance in maize, describe a method of testing resistance to *D. zeae* by raising seedlings in autoclaved, inoculated soil in glass lamp chimneys, incubated at 20°. Readings were taken three weeks after planting. In another test the outer covering of mature stalks was removed and the pith dried and ground. A significant difference was found in the size of the colonies grown on stalk meal from different inbred lines. The stalk meal of Os 426 supported the least fungus growth (average size of colony, 9·62 sq. cm.) and L 289 the most (39·8 sq. cm.). When ground stalk tissue from each line was extracted with hot distilled water, the extract reduced in volume, agar added, and plates poured and inoculated, the extract from Os 426 again supported the least, and that from L 289 the most, fungal growth. The properties of the mature stalk upon which growth and perhaps resistance or susceptibility to *D. zeae* stalk rot depend are, apparently, removable by hot water. Analysis of extracts from eight lines indicated a possible correlation between fungal growth on the ground stalk meal and the sucrose reserve in the stalk.

In studies by E. W. Lindstrom (reported on pp. 46–47) into the change of virulence in *Bacterium* [*Aplanobacter*] *stewarti* [ibid., xvii, p. 388] by repeated passage through susceptible and resistant inbred maize lines, the rate of change was most rapid in the first passages. Virulent strains of *A. stewarti* produce large, smooth, spreading, mucoid colonies, whereas avirulent strains form smaller, rather rough, raised, non-mucoid colonies. When a suspension of a known ratio of virulent to avirulent bacteria (determined by colony type) was inoculated into resistant and susceptible lines, selection in the host was for the avirulent type within the susceptible lines, and for the virulent type within the resistant line. The data obtained indicated that the rate of change per passage was higher in the susceptible than in the resistant line. Investigation of the extent to which the resistance of an inbred line can be changed by altering certain nutrient elements and environmental conditions showed that, with the treatments used, resistance decreased with the increase in nitrogen, ammonium producing more effect than nitrate. High concentrations of phosphorus decreased resistance, while high concentrations of calcium and potassium increased it. Low moisture, as compared with high moisture, and high, as compared with low light, increased resistance. Of

the treatments tested, nitrogen and water supply had the most pronounced effect.

STOREY (H. H.). **Investigations of the mechanism of the transmission of plant viruses by insect vectors. II. The part played by puncture in transmission.**—*Proc. roy. Soc.*, Ser. B, cxxv, 841, pp. 455–477, 2 pl., 1938.

This is a full account of the author's experiments in the investigation of the mechanism of transmission of maize streak virus by *Cicadulina mbila*, an abstract from which has already been noticed [*R.A.M.*, xvii, p. 386].

BÖNING (K.). **Helminthosporiosen an Mais.** [Helminthosporioses of Maize.]—*Prakt. Bl. Pflanzenb.*, xvi, 7–8, pp. 159–167, 5 figs., 1938.

The diseases of maize caused by species of *Helminthosporium* are stated to have attracted little attention so far in Germany. In the past year, however, a severe outbreak of brown spotting occurred in two localities in southern Bavaria on various maize varieties, causing premature death of the leaves. The fungus was identified as *Helminthosporium maydis* (the conidial stage of *Ophiobolus heterostrophus*), although it differed slightly from the descriptions by Drechsler [*R.A.M.*, v, p. 293] and Nisikado and Miyake [ibid., v, p. 734] in the colour of the spots (brown, sometimes with a bluish-violet margin), their size (3 by 2 to 80 by 30 mm.), in the less marked curvature of the conidia, and in cultural characters (poor development of conidia, which are shorter than usual). The careful removal of all straw is recommended, together with a well-regulated crop rotation. Seed disinfection is also advised, although there is no proof as yet that the disease is seed-borne.

CARRANTE (V.). **Il mal secco dei Limoni e i mezzi di lotta più consigliabili allo stato attuale delle conoscenze.** ['Mal secco' disease of Lemons and the methods of control recommended in the present state of knowledge.]—*Boll. Staz. Agrum. Frutt. Acireale*, 70, 32 pp., 28 figs., 1938.

The author gives a clear and succinct account in popular terms of the symptoms, method of spread, and control of 'mal secco' disease of lemons (*Deuterophoma tracheiphila*) [*R.A.M.*, xvii, p. 727]. The recommendations made on the last-named subject include the removal and destruction of affected branches, measures to tone up the general health of the trees, spraying, pruning, clipping instead of pulling off the fruit, the provision of wind-breaks, attention to soil factors, top-grafting on sweet orange [ibid., xii, p. 565] with bitter orange as the root stock, and a continued search for desirable resistant varieties. The susceptible 'Femminello comune' lemon variety is preferred by many growers to the resistant Monachello, as it comes into bearing much sooner after grafting (three years, as against seven for Monachello) and gives double the yield of much better quality fruit.

The advantages of top-grafting even the resistant Monachello lemon on sweet orange are that this practice reduces the incompatibility between bitter orange and Monachello, and that the resultant plant is rendered

immune from or highly resistant to the disease by the antibodies produced by the metabolism of the sweet orange. It has been proved that the sweet orange possesses thermostable and thermolabile substances which, in laboratory cultures, retard the development of the fungus, and it is considered that these may pass to the lemon.

La moississure bleue et la moississure verte des fruits d'Aurantiacées. (Penicillium italicum Wehm. et P. digitatum Sacc.). [The blue mould and green mould of Citrus fruits. (*Penicillium italicum* Wehm. and *P. digitatum* Sacc.).]—*Memento, Déf. Vég., Rabat*, 55, 12 pp., 2 pl., 1938.

A concise account is given in popular terms of the blue and green moulds (*Penicillium italicum* and *P. digitatum*, respectively) [*R.A.M.*, xvii, p. 741; xviii, p. 102] of citrus fruits in Morocco, together with full, practical recommendations for their control by the prevention of rind injury, improved methods of packing, chemical treatments, and cold storage.

Hwang (L.) & Klotz (L. J.). **The toxic effect of certain chemical solutions on spores of Penicillium italicum and P. digitatum.**—*Hilgardia*, xii, 1, pp. 1–35, 3 figs., 2 diags., 4 graphs, 1938.

With the object of securing an effective means of controlling the blue and the green moulds of citrus (*Penicillium italicum* and *P. digitatum*) [see preceding abstract], the authors conducted germination and dilution plate tests in which the spores of the two fungi were immersed in a number of chemical solutions of various concentrations and their subsequent viability compared with that of untreated spores. The spore suspensions were made up in 0·25 per cent. solutions of a non-toxic soap found to wet and disperse the spores effectively without impairing the germination, shaken for ten minutes, and then 5 c.c. of each of the suspensions transferred to sterile centrifuge tubes. These tubes were centrifuged for three minutes in order to precipitate the spores, the supernatant solution was then decanted, 10 c.c. of the chemical solution added, and the tube shaken thoroughly. About three minutes before the treatment time had elapsed the tubes were centrifuged, and at the end of the three minutes the chemical solution was decanted and the spores washed with distilled water. The germination tests were carried out in Van Tieghem cells, in fresh sweet orange juice, and at an incubation temperature of 77° F. In the dilution tests dilutions were transferred to Petri dishes, glucose potato agar added, and the colonies counted after two or three days' incubation at 77°.

Distilled water at 120° for five minutes killed about 90 per cent. of the spores. The results of tests in which the spores of the two fungi were exposed to 6 per cent. borax at 110° for 2, 4, 6, 8, 10, 12, 14, and 16 minutes, and at room temperature (66° to 72°), 80°, 100°, 110°, and 120° for five minutes, and to borax concentrations of 4, 6, 8, 10, and 12 per cent. for five minutes at 110°, showed that the longer the exposure, the higher the temperature and the stronger the concentration of the chemical, the more effective was the solution in reducing both the germination and the growth in plates. Similar

results were obtained with sodium carbonate and the new material, metbor, the latter, however, not being so toxic to the spores as borax. The toxicity of the various solutions to the spores of the two fungi appeared to depend more on temperature than on the concentration of the chemicals or the period of immersion. A five minutes' exposure at 120° to 6 per cent. borax-boric acid mixture, 6 per cent. metbor, 0·4 per cent. chloramine-T, or 6 per cent. sodium carbonate, was lethal to the spores of both fungi. In tests with dinitro-o-cyclohexylphenol, a substance shown by L. J. Klotz and L. L. Huillier in unpublished work to be effective in decreasing the number of brown rot (*Phytophthora citrophthora*) infections on lemon from 51·45 to 1·45 per fruit, exposure for two to five minutes to a saturated solution resulted in only a slight inhibitory effect on germination. A five minutes' exposure to 6 per cent. sodium bicarbonate at 86°, 100°, 110°, and 120° showed no advantage of the chemical over water. At 86°, exposure to a 10 per cent. solution of sodium bicarbonate for five minutes or to one of 6 per cent. for ten minutes, had little effect on the spores of either fungus. Exposures of two minutes to 0·4, 0·6, and 1·0 per cent. sodium hypochlorite killed the spores of both fungi. Apart from the last-named, the three most effective solutions, when used at 100° or below for five minutes, were 6 per cent. sodium carbonate, 0·15 per cent. sodium o-phenylphenate, and 6 per cent. borax; at 100° and 120° the most toxic were 0·4 per cent. chloramine-T, 6·0 per cent. sodium carbonate, and the 6 per cent. mixture (2:1) of borax-boric acid.

PERLBERGER (J.) & REICHERT (I.). **Experiments on the control of albinism in Citrus seedlings.**—*Palest. J. Bot.*, R Ser., ii, 1, pp. 40–78, 3 pl., 1938.

A fully tabulated account is given of the writers' studies on albinism in citrus seed-beds in Palestine [*R.A.M.*, xvi, p. 451], where the incidence of the condition ranges from 0 to 74 per cent. Some of the sweet lime [*Citrus limetta*], sour orange, grapefruit, and rough lemon seedlings examined were yellowish-white, while others were yellowish or partly white and partly green. In some cases the stem was white and the leaves green, in others the stem green and the foliage yellowish, whitish, or parti-coloured. In certain instances only the veins were green and the rest of the leaf yellowish-white, while occasionally the reverse condition was observed. Generally the first two leaves of the albino seedlings were white, while the third and fourth (the latter seldom developing) might be either white or very rarely green. Exposed to direct sunlight, albino plants degenerate in a few days, but in the shade or in a closed room they may be kept alive for five to eight weeks.

Extensive field and laboratory experiments showed that complete or almost complete control of the disorder is obtainable by 20 minutes' immersion of the seeds in uspulun, ceresan, or germisan, e.g., at $\frac{1}{8}$ or $\frac{1}{4}$ per cent., and by dusting with abavit. Soil treatments with the same preparations, however, did not give satisfactory results. In laboratory trials, dipping the seeds in solutions of cobalt nitrate (1/400 N), copper chloride (1/200 N), mercuric chloride (1/800 N), and nickel chloride (1/200 N) gave effective control.

The condition is regarded as an inherent constitutional defect, the

appearance of which at the time of seed germination may coincide with a disturbance of the enzymic system at this stage.

FAWCETT (H. S.). **Development of psorosis (scaly bark) in relation to origin and history of various Citrus varieties.**—*Calif. Citrogr.*, xxiv, 1, pp. 6, 30–32, 4 figs., 1938.

In summing up the available experimental and observational evidence on psorosis of citrus [*R.A.M.*, xviii, p. 248] the author states that the virus which is believed to cause this disease is usually systemic, so that all buds will transmit the infection. The different symptoms produced on the bark, known as psorosis A, psorosis B, concave gum disease, and possibly corky bark, are attributed to different virus strains which have varying degrees of virulence, just as different varieties of citrus seem to have varying degrees of susceptibility to the disease. The evidence collected by the author indicates that none of the original varieties, such as Navel and Valencia oranges or Eureka and Lisbon lemons, had the virus in it when first brought to California, but that it was present in some of the varieties subsequently top-worked to the original ones, and that the buds from these scions spread the disease when used for propagation. It appears, therefore, that psorosis could be avoided in future, if only buds from disease-free trees were taken for propagation, a measure facilitated by the registration of trees free from psorosis instituted as a voluntary service by the California Department of Agriculture. It is believed that by making use of this service the disease could be so greatly reduced in a generation that a subsequent campaign of eradication would entirely rid California of psorosis.

FAWCETT (G. L.). **La 'psorosis' en los Naranjos de Tucumán.** ['Psorosis' in Tucumán Oranges.]—*Rev. industr. agric. Tucumán*, xxviii, 4–6, pp. 101–103, 2 figs., 1938.

A popular note is given on the symptoms and mode of transmission of citrus psorosis [see preceding abstract] in connexion with the recent detection of the disease in oranges in Tucumán, Argentine Republic, by H. S. Fawcett and A. A. Bitancourt.

BRIXHE (A.). **Les parasites du Cotonnier au Congo belge.** [Cotton parasites in the Belgian Congo.]—*Bull. Com. coton. congol.*, iii, 11, pp. 72–95, 26 figs., 1938.

This is a useful key for the determination of the insect pests and diseases of cotton in the Belgian Congo, the latter including anthracnose [*Glomerella gossypii*: *R.A.M.*, xv, p. 719], collar canker [? *Neocosmospora vasinfecta*: ibid., ix, p. 33], wilt (verticilliosis or fusariosis) [? *Verticillium albo-atrum* or *Fusarium vasinfectum*: ibid., ix, p. 240; xiv, p. 224; xv, p. 719], damping-off (*Rhizoctonia*) [*Macrophomina phaseoli* and *Corticium solani*: ibid., ix, p. 32; xv, p. 578], capsule rot (*Diplodia*) [*gossypina*: ibid., xv, p. 719], mosaic [cf. ibid., xi, p. 239], internal bacterial rot, red rot [ibid., xv, p. 719], rust (*Alternaria*), stem blight (*Sclerotium*) [? *rolfsii*: ibid., xiv, p. 223; xvi, p. 95], and stigmatomycosis [*Nematospora coryli* and *N. gossypii*: ibid., xv, p. 719].

OKABE (N.). **Bacteriophage in relation to Bacterium malvacearum. II. Relation between variants and phage.**—*Ann. phytopath. Soc. Japan*, viii, 3, pp. 230–246, 1 pl., 1 fig., 1938. [Japanese, with English summary.]

All the nine variants derived from strain 427 of *Bacterium malvacearum*, isolated from angular leaf spots of cotton at Taihoku, Japan, were resistant to the bacteriophage extracted from the diseased foliar tissues by Matsumoto and Huzioka [*R.A.M.*, xvii, p. 521], while some of the 23 proceeding from strain 450 showed varying degrees of susceptibility, generally correlated with the dimensions of the plaques formed in the cultures. An increase in the incubation period coincided with plaque expansion in cultures of variants E, J, and M. The bacteriophage under investigation was found to consist of at least two primary elements, one active against all the variants and the other failing to induce lysis in E, J, M, O, and P. The size and number of plaques decreased more or less parallel with the amount of bacterial inoculum used (from 140 with an average diameter of 8·5 mm. after five days with one drop to 98 (4·2 mm.) with 32 drops). A fall in temperature led to an increase in the number and size of the bacteriophage plaques (1,368 with a diameter of 0·5 to 0·8 mm. after 48 hours at 28° as compared with 137, 0·2 to 0·5 mm., at 34° C. in the case of A^1), the corresponding figures after six days for J^1 at 25° and 34° being 150 (8·5 mm.) and 6 (0·3 mm.), respectively. There were no apparent morphological differences between the bacteriophage-resistant variants developed in culture and their susceptible progenitors.

LUTHRA (J. C.) & VASUDEVA (R. S.). **Studies on the root-rot disease of Cotton in the Punjab. V. Confirmation of the identity of Rhizoctonia bataticola.**—*Indian J. agric. Sci.*, viii, 5, pp. 727–734, 1 fig., 2 graphs, 1938.

Further studies have been undertaken to determine the exact systematic position of *Rhizoctonia bataticola*, strain 22 (*a*), which is jointly responsible with *R.* [*Corticium*] *solani* for root rot of cotton in the Punjab [*R.A.M.*, xvii, p. 33], in comparison with *R. bataticola*, isolated by Hopkins from banana roots [ibid., xiii, p. 494] in Rhodesia (strain 3113*c*), the same from lemon roots [ibid., xii, p. 727] (998), and *R. lamellifera* [ibid., xvi, p. 787] from lucerne roots. The cotton root rot strain closely resembled that from banana, and to a lesser extent the lemon isolation, on Vasudeva's synthetic medium, Richards's agar, and potato extract, the optimum growth of all three being made at 30° C., at which *R. lamellifera* develops very poorly. Strain 22 (*a*) further differs from the last-named in the production of white, later dark grey, colonies. The cotton strain tends to throw out saltants, the persistence of which requires further testing, on shallow-poured plates of Richards's agar. Strain 22 (*a*) also closely approximates to 3113*c* in its reactions to acidity or alkalinity of the medium, both growing best at P_H 4·8. Another similarity between the cotton and banana strains lies in their sclerotial dimensions (average 105·45$\pm$2·23 and 104·25$\pm$2·33 μ, respectively, compared with an average of 9·90 [? 990] $\pm$1·79 μ for *R. lamellifera*).

In soil inoculation tests on 43 F cotton (*Gossypium hirsutum*) plants, one series (20 days old) was maintained at a constant temperature of 30°, while two others (35- and 51-day-old plants) were kept in a greenhouse with fluctuations of temperature. The following mortality percentages were obtained in the three series: strain 22 (*a*), 83·33, 79·09, and 70·58, respectively; strain 3113*c*, 0, 0, and 0; strain 998, 15, 14·06, and 4; and *R. lamellifera*, 0, 0, and 0. The cotton and banana strains are thus quite distinct as regards pathogenicity, though closely similar in cultural characters. The former should therefore be regarded as a strain of *R. bataticola* [*Macrophomina phaseoli*].

Kokin (A. J.). К физиологии больного увяданием Хлопчатника. [On the physiology of the wilted Cotton plant.]—*ex* Symposium dedicated to the memory of V. N. Lubimenko, pp. 329–347, 2 figs., Ukr. S.S.R. Acad. Sci. Press, Kieff, 1938. [English summary.]

The experiments described in this paper were carried out under hothouse conditions in Leningrad during the summer of 1935 to investigate the mechanism and physiology of wilting in the cotton plant. Potted plants of *Gossypium herbaceum* No. 7450 (from west China) were inoculated with pure cultures of *Fusarium buharicum* [*R.A.M.*, xvii, p. 109] through incisions at the base of the stems, and potted plants of the American Upland No. 1306 cotton were inoculated by mixing microsclerotia of *Verticillium dahliae* [ibid., xvii, p. 814] in the soil in which they were grown. The plants in the first series wilted suddenly 18 to 21 days after inoculation, after which they rapidly died; in the second series the Upland cotton plants did not wilt, apart from a few exceptions, presumably owing to unfavourable weather conditions (predominantly overcast), but the typical discoloration of the internal tissues of the stems evidenced the successful establishment of the fungus in the plants. Sharp disturbances were observed in the water balance of the wilting *G. herbaceum* plants, as indicated by a considerable decrease in the intensity of transpiration (66·8 per cent. of that in the controls), and by the fact that in the diseased plants the water content of the leaves in the afternoon was 35 per cent. of that calculated in the morning, while in healthy plants it dropped to 25 per cent. of the morning content. As wilting occurred in soil containing 50 to 60 per cent. of its maximum moisture-holding capacity, it is considered to have been due to other causes than lack of soil moisture. The determination at two different dates of the total soluble carbohydrates in the leaves of infected *G. herbaceum* plants before wilting, at the onset of wilting, and in severely wilted plants gave 10·09, 10·45, and 11·02, and 12, 12·38, and 20 per cent. of the dry weight, respectively, as against 6·21 and 10·47 per cent., respectively, in the healthy plants. The protein content of the leaves, on the other hand, was found on the same dates to have been lowered to 20·62, 20·62, and 20·21, and 19·93, 19·81, and 18·31 per cent. of the dry weight, respectively, from 21·06 and 20·6 per cent., respectively, in the controls. The fact that the osmotic pressure of the cell sap in diseased *G. herbaceum* leaves was higher than in healthy plants is attributed to the accumulation in the former of soluble carbohydrates and to hydrolysis of their proteins. When excised portions of healthy *G. herbaceum* leaves were kept in an extract of a diseased

stem, the cells were killed in 18 to 20 hours, but remained alive when they were kept in extracts of healthy stems, demonstrating the secretion of toxic substances by *F. buharicum*.

The results of the studies on Upland cotton are stated to have shown that in leaves exhibiting distinct symptoms of the disease the activity of catalase is somewhat decreased as compared with that in the healthy plant, while the activity of peroxidase is considerably increased, in some cases up to almost twice that in healthy plants. The osmotic pressure of the cell sap in the leaves of infected plants was found to be higher than in healthy; this is explained by an insufficient water supply to the leaves due to a partial stoppage of the vessels by the hyphae of the fungus.

COMANDON (J.) & DE FONBRUNE (P.). **Recherches expérimentales sur les champignons prédateurs de Nématodes du sol. Conditions de formation des organes de capture. Les pièges garrotteurs. Les gluaux ou pièges collants.** [Experimental studies on fungi preying on soil Nematodes. Conditions of formation of organs of capture. Strangling traps. Snares or adhesive traps.]—*C.R. Soc. Biol., Paris*, cxxix, 30, pp. 619–625, 1938.

Dactylaria brochopaga [originally described as *Dactylella brochopaga* but figured as *Dactylaria brochopaga*: *R.A.M.*, xvii, p. 36], *Dactylella bembicodes*, *D. ellipsospora*, *Arthrobotrys oligospora*, and *Stylopage hadra* [loc. cit. and cf. ibid., xvii, p. 597] were isolated from the soil in the garden of the Institut Pasteur annex at Garches [near Paris], and induced to form their typical organs of capture [see above, p. 232] (strangling loops in the two first-named, pads of adhesive substance in the other three) by the addition to a beer wort and Quaker oats agar medium of nematode eggs, sterilized in 10 per cent. eau de Javelle or of water previously occupied by the living eel-worms in a sterile condition. The modes of formation of the different organs of capture and their application are very fully described.

GOODEY (T.). **Observations on the destruction of the stem Eelworm, Anguillulina dipsaci, by the fungus Arthrobotrys oligospora Fres.**—*J. Helminth.*, xvi, 3, pp. 159–164, 4 pl., 1938.

In March, 1938, the leaves of Little Gem yellow calceolarias (*Calceolaria integrifolia*) submitted for examination from the South-Eastern Agricultural College, Wye, Kent, showed a brownish-black discoloration and swelling of the tissues near the main vein on the under side of the petiole, due to heavy parasitization by *Anguillulina dipsaci*, large numbers of which were found to be entangled in the hyphal rings or loops of a fungus forming in a moist atmosphere piriform, uniseptate conidia, 22 to 25 by 10 to 12 μ, agreeing with Drechsler's description of *Arthrobotrys oligospora* [see preceding abstract]. The same fungus is believed to have been implicated in the destruction of *Anguillulina dipsaci* in the rotted crowns and blackened leaves of *Saxifraga cotyledon* from the Royal Horticultural Society's Garden, Wisley, Surrey, examined in 1928. Presumably the fungus enters the plant either by the spread of the hyphae into the tissues from the soil, or by means of conidia splashed on to it in the course of watering.

Charles (Vera K.). **A new entomogenous fungus on the Corn earworm, Heliothis obsoleta.**—*Phytopathology*, xxviii, 12, pp. 893–897, 3 figs., 1938.

English and Latin diagnoses are given of *Spicaria heliothis* n.sp., found parasitizing pupae of the maize earworm (*Heliothis obsoleta*) in hibernation cages at the Arlington (Virginia) Experimental Farm in 1936, 1937, and 1938. The bodies of the insects contained a densely packed mass of white, septate mycelium, completely occluding all the organs except the alimentary canal, and accompanied in the younger material by blastocysts similar to those described by Speare for *Sorosporella uvella* (*J. agric. Res.*, xviii, pp. 399–440, 1920). Occasionally a cobweb-like growth was exuded through the sutures and spread over the surface of the body.

The fungus grew readily on various standard media, forming white, sometimes zonate colonies and slender synnemata on Molisch, potato, and maize meal agar, while on wort the synnemata were broadly flabelliform and flattened. *S. heliothis* is characterized by solitary or gregarious synnemata, 1 to 1·5 cm. in height, simple or branched conidiophores bearing 3 to 8 whorls of 3- to 5-verticillate or irregularly grouped, oblong pro-phialides, 7 to 8 μ; globose phialides with short sterigmata; and variable, ovate to elliptical conidia, in long chains, 5 to 7 by 3 to 3·5 μ.

Kambayashi (T.). **Über eine neue Varietät von Scopulariopsis blochi als Erreger einer Dermatomykose.** [On a new variety of *Scopulariopsis blochi* as the agent of a dermatomycosis.]—*Bot. Mag., Tokyo*, lii, 624, pp. 635–641, 3 figs., 1938.

Full details are given of the cultural and morphological characters of a species of *Scopulariopsis* recently isolated from a toe-nail infection in a 67-year-old man in Japan, where the occurrence of representatives of this genus as human pathogens is stated to be exceedingly rare. The fungus under observation differs from the related *S. minimum* [*R.A.M.*, ix, p. 720] in its larger conidia (3·2 by 2·5 μ), absence of phialids, and colour of the colonies, and is considered to approximate most nearly to *S. blochi* (spore dimensions 3 to 4 by 1·5 to 2 μ), from which it must be distinguished, however, by its failure to form perithecia. The newly detected agent of onychomycosis is accordingly recorded as a new variety of *S. blochi*, but is not named.

Mosto (D.). **Die blastomykotischen Granulome.** [The blastomycotic granulomata.]—*An. Fac. Med. Montevideo*, xxiii, pp. 585–596, 1938. [Spanish. Abs. in *Zbl. Haut- u. GeschlKr.*, lxi, 1–2, p. 33, 1938.]

A description, accompanied by a number of histological illustrations, is given of the changes induced by *Paracoccidioides brasiliensis* [*R.A.M.*, xvii, p. 598] in various human organs.

Baker (R. D.). **Comparison of infection of Mice by mycelial and yeast forms of Blastomyces dermatitidis.**—*J. infect. Dis.*, lxiii, 3, pp. 324–329, 5 figs., 1938.

In experiments at the Duke University School of Medicine, North

Carolina, the mycelial form of a strain of *Blastomyces* [*Endomyces*] *dermatitidis* [*R.A.M.*, xviii, p. 179] grown on Sabouraud's medium at room temperature was found to be as effective as the yeast phase, isolated from a 37-year-old negro and cultured on blood agar at 37° C., in causing the death of mice and extensive abdominal and pulmonary lesions, when weighed equivalent dosages were injected intraperitoneally.

VENTURI (T.). **Contributo alla così detta blastomicosi cutanea. Un caso di dermatoendomicosi da Endomyces albicans Vuillemin con grave setticemia.** [A contribution to the knowledge of the so-called cutaneous blastomycosis. A case of dermatoendomycosis due to *Endomyces albicans* Vuillemin, with acute septicaemia.]—*Dermosifilografo*, xiii, pp. 450–466, 1938. [Abs. in *Zbl. Haut- u. GeschlKr.*, lxi, 5, p. 263, 1939.]

A description is given of a case of dermatoendomycosis with acute septicaemia caused by *Endomyces albicans* [*R.A.M.*, xiv, p. 582].

LANGERON (M.) & GUERRA (P.). **Nouvelles recherches de zymologie médicale.** [New researches in medical zymology.]—*Ann. Parasit. hum. comp.*, xvi, 1, pp. 36–84; 2, pp. 162–179; 5, pp. 429–473; 6, pp. 481–525, 22 pl., 3 figs., 1938.

In this paper, a preliminary note on which has already appeared [*R.A.M.*, xvi, p. 480], an exhaustive account is given of further researches on the yeast-like fungi previously studied by the senior author [ibid., xi, p. 476], the methods used being described in detail. Following a historical survey of the work done on the systematic position of the yeast-like fungi, and a discussion of the present state of the problem, the authors describe in detail the 16 species of anascosporous, yeast-like fungi which they consider to be at present alone valid in medical zymology. All are placed in the genus *Candida* Berkhout 1923, in which they are arranged in seven groups. The following diagnosis [in French] is given of the genus, as now emended: yeast-like, anascosporous fungi (Torulopsidaceae-Mycotoruloideae sensu Lodder 1934) regularly parasitic on man and mammals, capable of developing a filamentous apparatus on suitable media. This, consisting solely of catenulate blastospores (sensu Vuillemin 1910) is a pseudomycelium (sensu Langeron and Talice 1932) [ibid., xi, p. 476] represented by verticils of blastospores which develop at the apex of each joint and are arranged at regular intervals. The pseudomycelium and the sporulating apparatus separate the Mycotoruloideae from the Torulopsoideae (Lodder), but are sometimes also found in the ascosporous yeasts. They are an imperfect form of reproductive mechanism, analogous to the conidial states of the other Ascomycetes. Fermentative ability is absent, or more or less developed; in the latter case characteristic for certain sugars or groups of sugars. The 16 species considered valid are divided into groups as follows: (1) *C. albicans* group (including *C. albicans* and *C. triadis*), fermenting glucose and maltose, and having chlamydospores; (2) *C. tropicalis* group (including *C. tropicalis, C. intermedia,* and *C. pelliculosa*), fermenting glucose, maltose, saccharose, showing a ring and a mucous veil, and not assimilating urea; (3) *C.*

pseudotropicalis group (including only this species), fermenting glucose, saccharose, lactose, raffinose, not maltose, and assimilating urea; (4) *C. guilliermondi* group (including *C. guilliermondi* and *C. chalmersi*), fermenting glucose and saccharose, not maltose or lactose, negative urea auxanagram; (5) *C. krusei* group (including *C. krusei*, *C. parakrusei*, and *C. aldoi*), fermenting only glucose and levulose; (6) *C. brumpti* group (including *C. brumpti* and *C. flareri*), fermenting glucose weakly and levulose very weakly, and not assimilating urea; and (7) the azymatic group, not fermenting any sugar, which consists of *C. zeylanoides*, *C. deformans*, and *C. suaveolens*.

AMBROSIONI (P.). **Allantospora violacea n.sp. ritrovata in un caso di erosione interdigitale.** [*Allantospora violacea* n.sp. detected in a case of interdigital eruption.]—*Riv. Parasitol.*, ii, pp. 151–158, 1938. [Abs. in *Zbl. Haut- u. GeschlKr.*, lxi, 3, p. 118, 1939.]

A Latin diagnosis is given of *Allantospora violacea* n.sp., isolated at the Microbiological Institute, Rome University, from an eruption of the interdigital spaces and soles of the feet.

DURHAM (O. C.). **Incidence of air-borne fungus spores. II. Hormodendrum, Alternaria, and rust spores.**—*J. Allergy*, x, 1, pp. 40–49, 2 figs., 1 graph, 1 map, 1938.

Further studies on the incidence and distribution of *Alternaria* and *Hormodendrum* spores at different seasons in all parts of the United States [*R.A.M.*, xviii, p. 108] and certain localities (Winnipeg and Toronto) in Canada indicate that the total figures for the two groups are approached by none of the other larger air-borne spores except those of the rusts and smuts. At times *Aspergillus*, *Penicillium*, and *Phoma* spores also occur in large numbers on the trap slides, but in most cases there is good evidence of the multiplication of these organisms after they reach the slide. A map depicts the striking similarity in the quantitative geographical distribution of *Alternaria* and *Hormodendrum* not only as compared with one another but also in relation to ragweed [*Ambrosia artemisifolia*], an abundance of one of the three showing a correlation with the profuse development of the other two. In this connexion, attention is drawn to the comparable soil and moisture requirements of wheat and ragweed. The latter being definitely excluded as a host of the two fungus groups under discussion, it is suggested that the straw of wheat and other small grains may well afford an ideal natural substratum for the growth of these moulds. The maximum production of both *Alternaria* and *Hormodendrum* is reached in the north-central States and the minimum in the arid region west of the Rocky Mountains. The three months of heavy production are the same both in the north and south, viz., July, August, and September. From the data so far obtained *Hormodendrum* is generally more abundant than *Alternaria* in May and June, while in November the positions are reversed. Detailed statistics for the evaluation of the spores of these moulds as sources of inhalant allergy are presented in tabular form.

During 1937 two distinct heavy showers of stem rust of cereals [*Puccinia graminis*] were observed, the first about 12th June in central

Oklahoma, eastern Kansas, eastern Nebraska, Missouri, Illinois, and Indiana from winter wheat, and the second and more severe in Minnesota from spring wheat during July, when the maximum number of spores trapped at Moorhead (on 22nd) was 10,000.

Grigoraki (L.) & David (R.). **Complément à l'étude des caractères biochimiques de Trichophyton crateriforme et Achorion violaceum.** [Supplement to the study of the biochemical characters of *Trichophyton crateriforme* and *Achorion violaceum*.]—*C. R. Soc. Biol., Paris*, cxxix, 30, pp. 647–649, 1938.

A study of the action of *Trichophyton crateriforme* and *Achorion violaceum* [*R.A.M.*, xvii, p. 818] on glucids and glycerine by means of the 'litmus test' showed that the colour shades (Klincksieck and Valette) produced by the former on glucose, mannose, galactose, saccharose, lactose, maltose, inulin, dextrin, and glycerine were orange-yellow 156, orange 136, orange 136, purple-red 553, violet 502, violet 526, violet-red 553, violet-red 553, and violet 506, respectively, the corresponding tones for the latter being red 31, red 11, red 11, violet-red 576, violet-red 577, violet-red 577, violet-red 577, violet-red 582, and violet-red 556, respectively.

Semeniuk (G.) & Ball (W. C.). **Some moulds associated with meat in cold storage lockers in Iowa.**—*Proc. Ia Acad. Sci., 1937*, xliv, pp. 37–43. [? 1937. Received December, 1938.]

The following moulds have been isolated from meat in cold storage locker plants in Iowa: *Thamnidium elegans*, *T. chaetocladioides* [*R.A.M.*, xiii, p. 442], *Cladosporium herbarum* [ibid., xiii, p. 701], four strains of the *Aspergillus glaucus* [ibid., viii, p. 785] group (comprising *A. repens*, *A. ruber*, and *A. chevalieri*), seven cultures of the *asymmetrica-velutina* group of *Penicillium*, and strains approximating to *P. chrysogenum*, *P. notatum*, *P. puberulum* [ibid., xiii, p. 514], and *P. melinii*. It is pointed out that since meat is frequently stored in these lockers for six months or a year at fluctuating temperatures, sometimes exceeding the critical degree for mould development of 32° F., an improvement in the present system is urgently necessary in the public interest.

Calinisan (M. R.). **Transmission experiment of Abacá mosaic. (Progress report No. 1.)**—*Philipp. J. Agric.*, ix, 3, pp. 309–312, 3 pl., 1938.

Mosaic disease of *Musa textilis* [*R.A.M.*, xvii, p. 40], first observed by the author in the Philippine Islands in 1933, has now become one of the major diseases of this host locally. Attempts at transmission under greenhouse conditions through soils, by contact, and by inoculation, all gave negative results. When, however, five healthy plants of two varieties and a potted healthy seedling were planted in the greenhouse side by side with other infected plants heavily infested with *Pentalonia nigronervosa*, only one plant failed to develop mosaic symptoms. The evidence thus appears to indicate that *P. nigronervosa* plays some part in transmission, though further experiments are necessary in this regard.

Calinisan (M. R.). **The three destructive diseases of Abacá in Davao (bunchy-top, mosaic, and the vascular disease) and their control.**—*Philipp. J. Agric.*, ix, 3, pp. 329–333, 3 pl., 1938.

Short, popular notes are given on the symptoms, causes, and control of the three chief diseases of abacá [*Musa textilis*] occurring in Davao, Philippine Islands, viz., vascular disease or wilt [? *Fusarium oxysporum* var. *cubense*: *R.A.M.*, xviii, p. 30], bunchy top [ibid., xvii, p. 40], and mosaic [see preceding abstract].

Vinogradoff (V. P.), Kapustina (Mme E. I.), Popova (Mme T. T.), & Shevtchenko (A. N.). Методика определения посевных качеств и фитопатологической экспертизы семян Льна. [Instructions for the determination of the germinative value of Flax seeds and for their phytopathological examination.]—80 pp., 26 figs., Госуд. Издат. Колх.-совх. Литер. „Сельхозгиз" [St. Publ. Off. Lit. collect. co-op. *Fmg* 'Selkhozgiz'], Moscow, 1937. [Received November, 1938.]

Official instructions approved by the Pan-Soviet Scientific Research Institute of the Flax Industry are given in this booklet for the determination of the germinability of flax seed and its freedom from contaminating organisms. A brief account is added of the chief fungi and bacteria usually present on the flax seed, such as *Fusarium* spp., *Ascochyta* [*linicola*: *R.A.M.*, xv, p. 369], *Polyspora* [*lini*: ibid., xviii, p. 111], *Colletotrichum lini* [loc. cit.], a 'fungus sterilis', and various saprophytes. The sterile fungus is stated to cause a brick-red spotting on the cotyledons and a streaking of the same colour on the radicles; heavily infected seed usually damps off, but slight contamination is not dangerous.

Wilson (R. D.). **A bacterial disease of Stocks.**—*J. Aust. Inst. agric. Sci.*, iv, 4, pp. 212–215, 1 fig., 1938.

During 1938, stocks (*Matthiola incana* var. *annua*) growing in various localities in New South Wales were affected by a bacterial disease apparently new to Australia, which caused heavy losses in some plantings. The affected plants were stunted, and the lower leaves turned yellow and dropped off; in severe cases, the plants wilted, and often died. Black, sunken, water-soaked lesions appeared at the points of attachment of the leaves to the stem and of the subsidiary stems to the main stem. Internally, the vascular area and the adjacent tissues were blackened.

Inoculations of stock seedlings, made by means of needle punctures on the stems, gave rise to typical symptoms, and the organism was reisolated. Inoculations on other crucifers were unsuccessful. The organism is a Gram-negative, non-spore-forming, aërobic rod measuring 1·5 to 3 by 0·6 to 0·9 μ, motile by one polar flagellum, producing a copious yellow growth on beef extract peptone agar and potato dextrose agar, hydrolysing starch, liquefying gelatine, not producing indol from tryptophane broth, and not reducing nitrates to nitrites. Growth occurred on a solid medium with the production of acid when dextrose, sucrose, galactose, raffinose, levulose, xylose, arabinose, mannose, mannitol, glycerol, and maltose were used as the sources of carbon.

The disease is probably the same as that recently recorded by Ken-

drick from California [abs. in *Phytopathology*, xxviii, 1, p. 12, 1938], and the causal organism is probably closely related to, but not identical with, *Bacterium campestre* [*Pseudomonas campestris*: see next abstract].

BURKHOLDER (W. H.). **A bacterial blight of Stocks caused by Phytomonas syringae.**—*Phytopathology*, xxviii, 12, pp. 935–936, 1938.

Inoculation experiments with two virulent strains of *Phytomonas* [*Pseudomonas*] *syringae* [*R.A.M.*, xviii, p. 154], one from lilac and the other from Lima beans [*Phaseolus lunatus*], on flowering stocks (*Matthiola incana* var. *annua*) in the greenhouse at Cornell University, New York, resulted in the development of symptoms identical with those described by Briosi and Pavarino from Italy and Adam and Pugsley from Victoria as due to *Bacterium matthiolae* [ibid., xiii, p. 747]. Simultaneous inoculations of stocks with *Phytomonas* [*Bact.*] *maculicola* from cauliflower gave negative results. It is apparent from the outcome of these tests that the stock is one of the many hosts of *Pseudomonas syringae*, of which *Bact. matthiolae*, in view of the close similarity of its symptoms, is believed to be a synonym. On the other hand, a disease of stocks reported by Kendrick from California [cf. preceding abstract] caused by a pathogen similar in appearance to, but not identical with, *Phytomonas* [*Pseudomonas*] *campestris*, is distinct.

MCWHORTER (F. P.). **Correlation between self-breaking and blue nuclei among certain commercial Tulip varieties.**—*Science*, N.S., lxxxviii, 2287, p. 411, 1938.

Recent studies on the new race of Mendel tulips have shown that every red variety bearing flowers with a white ground and blue base self-breaks or darkens when inoculated with tulip virus I (colour-removing) [*R.A.M.*, xvii, p. 603]. Of 49 red varieties investigated, 21 reveal a blue pigment in the epidermis of the basal portion occurring (1) free in the cytolymph of the epidermal cells, (2) as prismatic crystalline masses, (3) within the nuclei of the cells, or (4) in combinations of these three positions. The nuclei are often so blue as to disclose no structural characters. Nuclear pigmentation reaches a climax in cells in a state of incipient degeneration, but is also evident in apparently sound material. Blue nuclei are found in the bases of red Darwin tulips, which also self-break in the presence of the colour-removing virus.

SCHANDER (H.). **Untersuchungen über die Abhängigkeit der Jugendchlorose von Lupinus luteus von Aussenfaktoren während ausschliesslicher Ernährung durch die Keimblätter in Wasserkultur. 1. Die Wirkung einzelner Salze und der Reaktion. 2. Die Wirkung der Reaktion und Salzkonzentration der Nährlösung.** [Studies on the dependence of the juvenile chlorosis of *Lupinus luteus* on external factors during exclusive nutrition through the cotyledonary leaves in water culture. 1. The influence of individual salts and the reaction. 2. The influence of the reaction and salt concentration of the nutrient medium.]—*Bodenk. u. Pfl-Ernähr.*, N.S., xi, 1–2, pp. 32–49; 5–6, pp. 278–283, 22 graphs, 1938.

A fully detailed account is given of the methods specially devised by the author, at the Kaiser Wilhelm Institute for Breeding Research,

Müncheberg, Mark, Germany, for the determination of juvenile chlorosis in three selected strains of Weiko yellow lupins (*Lupinus luteus*) [*R.A.M.*, xvi, p. 42] and the influence on the disorder of various compounds of calcium, magnesium, sodium, potassium, ammonium, and strontium. The results of the water culture tests showed that no chlorosis develops at the optimum reaction for the growth of the plant (P_H 4·8 to 5), but beyond these limits the symptoms occur in varying intensity in the presence of the individual salts, increasing parallel with distance from the optimum in the case of a constant salt concentration, and with a rising concentration where a constant reaction is maintained. The severity of the disease was also found to depend on the nature of the active cations of the salts, the adverse effects of which operated through the following descending scale: ammonium, magnesium, calcium, potassium, sodium, and strontium.

WEIHING (R. M.), ROBERTSON (D. W.), & COLEMAN (O. H.). **Survival of several Alfalfa varieties seeded on irrigated land infested with bacterial wilt [Phytomonas insidiosa (McCulloch) Bergey et al.].**—*Tech. Bull. Colo. agric. Exp. Sta.* 23, 12 pp., 1 diag., 1938.

Ten trials of different varieties of lucerne on land infested with bacterial wilt (*Phytomonas insidiosa*) [*Aplanobacter insidiosum*: *R.A.M.*, xvii, p. 301] were conducted on various experimental farms in Colorado, where the plants were grown in one-tenth or one-half acre plots, two permanent quadrates, 1 m. sq., being reserved in each plot for making spring and autumn stand counts. The first count made in the autumn of the first year of harvesting, when all the stands were thick enough for excellent hay yields, showed an average of 46·4 plants per quadrate for the ten tests. In seven tests in which the initial counts averaged 43·7 plants per quadrate, the autumn counts of the third harvest year averaged 19·4 plants and the stands were too thin for further hay production. In these seven tests there was a consistent decrease of 6·1 plants per quadrate between successive spring and autumn and autumn and spring counts. In the following spring stand counts in four of these tests averaged 9·8 plants per quadrate. One test with four varieties averaged 48·4 and 16·2 plants per quadrate for the initial and the fourth autumn counts, respectively, while two tests averaged 55·1 and 22·1 plants per quadrate for the initial and fifth autumn counts, respectively. Thus, most varieties were too thin for hay production after the third or fourth year of harvesting, with the exception of Hardistan, which survived and remained productive for one or even two or more further years, the commercial strain No. 2674 from Turkestan coming next. The survival of Chilean and Argentine was as low as that of any of the varieties, and there seemed to be little difference in the average survival of variegated and common strains of lucerne.

PORCHET (BERTHE). **Contribution à l'étude de la levure Torulopsis pulcherrima.** [A contribution to the study of the yeast *Torulopsis pulcherrima*.]—Reprinted from *Ann. Ferment.*, N.S., iv, 7, 20 pp., 21 figs., 1938.

A detailed description is given of the author's comparative study of

ten strains of *Torulopsis pulcherrima* [cf. *R.A.M.*, xiv, p. 523; xvii, p. 676] obtained from cherries, plums, apples, and grapes in Switzerland. Six strains showed all the characteristics described by Lodder for the species [cf. ibid., xiv, p. 193], but of the remainder, one had a distinct pseudomycelium on wort, another showed the presence of conidia at the extremity of the cellular prolongations, and a third gave two types of colonies. These four aberrant strains had certain characters connecting them with the Mycotoruloideae.

SIEMASZKO (W.). **Brudna plamistość Jabłek powodowana przez grzyb Gloeodes pomigena (Schw.) Colby.** [Sooty blotch of Apples caused by the fungus *Gloeodes pomigena* (Schw.) Colby.]—*Roczn. Nauk ogrod.*, iv, pp. 57–63, 4 figs., 1937. [English summary. Received February, 1939.]

Gloeodes pomigena [*R.A.M.*, xvi, p. 758] was first observed in Poland in 1934 on market apples of the Graham Pippin variety, but also occurred in 1937 in other localities on Harbert's and Landsberg Pippins and later on fruit in cold storage in Warsaw. It was sometimes observed in association with the fly speck fungus *Leptothyrium pomi*, but more often the latter was found alone.

BLODGETT (F. M.). **The spread of Apple mosaic.**—*Phytopathology*, xxviii, 12, pp. 937–938, 1938.

Of 1,207 apple trees in nine orchards in New York State surveyed in 1927 and still extant in 1932, 72 showed symptoms of mosaic [*R.A.M.*, xvi, p. 687] in the former and 109 in the latter year, representing a 51·4 per cent. increase over the five-year period. At the close of a further five-year period, 163 out of 981 trees were diseased compared with 96 in 1932, an increase of 69·8 per cent. Of 914 trees examined both in 1927 and 1937, 138 showed mosaic at the end of the ten-year period as against 31 at the beginning. All these differences, when analysed by the X^2 test, are significant. The somewhat slow spread of the disease is believed to be associated with pruning operations rather than with insect transmission.

GOLDSWORTHY (M. C.) & SMITH (M. A.). **An Apple leafspot associated with Fabraea maculata.**—*Phytopathology*, xxviii, 12, p. 938, 1938.

In June, 1938, pear, French crab apple, and McIntosh apple leaves were observed at the United States Horticultural Station, near Beltsville, Maryland, to bear the black, blister-like acervuli of *Fabraea maculata* [*R.A.M.*, xvi, p. 759; xviii, p. 38, and below p. 261], and microscopic examination disclosed the presence of the typical *Entomosporium* [*maculatum*] conidia in the lesions on all three hosts.

YOSSIFOVITCH (M.). **Puccinia pruni-spinosae Persoon.** Прилог проучавању сузбијања рђе на Шљиви. [*Puccinia pruni-spinosae* Persoon. A contribution to the study of the control of rust on Plums.]—*Ann. Trav. agric. sci., Belgrad*, v, 12, pp. 49–59, 2 figs., 1938. [French summary.]

Rust of plums, caused by *Puccinia pruni-spinosae* [*R.A.M.*, xviii,

p. 190], is stated to occur regularly in Yugoslavia, causing in some years (e.g., 1936) very serious damage and complete defoliation of the trees, especially of the most important variety Požegača (Hungarian domestic plum).

The results of spraying experiments on this variety, conducted in 1938 in a village of the Kosmaj district, showed that the success of treatment with Bordeaux mixtures depended on the date of application. Spraying either on 27th May or 18th June with a 2 per cent. Bordeaux mixture and 2 per cent. skim milk gave complete control of the disease, whereas earlier applications had little or no effect. The spraying prevented both the primary infection by aecidiospores and the secondary infection by uredospores. It has thus been demonstrated that complete control of rust can be achieved by one treatment, provided it is applied when the foliage is almost completely developed.

Cochran (L. C.) & Hutchins (L. M.). **Further studies on host relationships of Peach mosaic in southern California.**—*Phytopathology*, xxviii, 12, pp. 890–892, 1 diag., 1938.

Almond, apricot, plum, and prune mosaics [cf. *R.A.M.*, xviii, p. 188], occurring spontaneously in southern California, have already been shown to produce peach mosaic-like symptoms on peach after graft inoculations, and the present paper gives further details of observations and experiments on the host relationships of peach mosaic.

In September, 1937, healthy apricot nursery trees were grafted with buds from mosaic-diseased peaches. Growth from the inserted peach buds showed severe mosaic symptoms in the following spring, whereas the apricot portion remained apparently healthy, though peach scions grafted on the apricot limbs the following spring developed mosaic, showing that the virus was present in the apricot without inducing external manifestations of the disease. Plums and prunes behaved in a similar manner to the apricot.

Further data show that the peach mosaic virus may be present in a latent form in almond for at least three years. Naturally occurring almond, apricot, and prune mosaics were transmitted from infected to healthy trees of the respective species, the incubation period approximating to that of peach mosaic in peach. Apricot mosaic was transmitted by grafting to peaches and vice versa. Spontaneous mosaic in the almond, inoculated into healthy apricots, caused typical apricot mosaic in the latter. Surveys of commercial plum and prune orchards adjoining peach orchards with 75 per cent. mosaic disclosed no signs of infection in the two first-named, and grafting tests showed them to be free from peach mosaic.

It is apparent from these data that, while certain naturally occurring almond, apricot, and plum disorders of the mosaic type are capable of producing peach mosaic-like symptoms in peach by graft inoculations, a reciprocal relationship may not hold good. Almonds, apricots, and plums may serve as symptomless carriers of the peach mosaic virus acquired by inoculation. Further experiments are necessary to determine whether there is actually more than one mosaic virus of *Prunus* spp. in California, as the available evidence would appear to indicate.

SCHNEIDERHAN (F. J.). **Control of Cherry leaf-spot in West Virginia.**—*Bull. W. Va agric. exp. Sta.* 288, 13 pp., 5 figs., 1938. [Abs. in *Exp. Sta. Rec.*, lxxx, 1, p. 65, 1939.]

If neglected, cherry leaf spot (*Coccomyces hiemalis*) [*R.A.M.*, xvii, pp. 608, 694] causes defoliation, yield reduction, and devitalization of the trees, predisposing to winter injury, in West Virginia, where the fungus overwinters in the dead leaves, producing ascospores as a source of primary infection about blossom time. Secondary infection is spread by the conidia formed in the foliar lesions. Ascospore discharge records indicate that infection may take place before the petal-fall spray, hitherto the first applied under local conditions. The results of two years' tests have shown that a pre-blossom fungicidal treatment is as likely to prevent spring attacks of leaf spot as the petal-fall application, while a post-harvest spray should also be given to counteract late infection (which was extremely heavy in August and September from 1934 to 1937) and abundant carry-over of the fungus.

MCWHORTER (O. T.). **Zinc helps combat "little leaf" in fruit trees.**—*Bett. Fruit*, xxxiii, 5, p. 15, 1938.

Little leaf of fruit trees [*R.A.M.*, xvii, p. 692; xviii, pp. 43, 187] was successfully controlled by means of zinc sulphate sprays, zinc glazier tacks, and zinc sulphate injections in over 300 demonstrations and trials in Oregon. Zinc sulphate, applied as a dormant spray at the rate of 50 lb. in 100 gals. water at four-day intervals on cherry trees at the time of bud opening, caused no damage to buds or foliage, although under certain conditions such sprays may be injurious at this stage. Excellent results were obtained with 18 to 25 lb. zinc sulphate in 100 gals. water applied as a foliage spray in May, June, and early July, either with or without lime (1 lb. to each 3 lb. zinc sulphate). Zinc sulphate sprays applied at the rate of 12 lb. per 100 gals. water with spreader gave as complete control within 40 days as did zinc sulphate at the rate of 25 lb. without spreader, and good control was also obtained with 6 lb. with spreader. Foliar injury occurred when spraying with zinc sulphate and spreader on 16th June was followed within 48 hours by rain and wind, severe damage (40 to 50 per cent. of the leaves turning yellow and dropping) being observed in the case of spreader and 12 to 18 lb. per 100 gals., and slight in that of spreader and 3 or 6 lb. per 100 gals. The results of experiments conducted at The Dallas in Wasco County, Oregon, seem to indicate that boron and zinc sulphate used together give a more lasting control of little leaf.

MOORE (M. H.). **Leaf blight on Medlar in England.**—*Gdnrs' Chron.*, civ, 2712, pp. 440–441, 2 figs., 1938.

A semi-popular note is given on an attack of leaf blight (*Entomosporium maculatum*) on medlars (*Mespilus germanica*) in a Kentish garden in July, 1938; this is stated to be only the second record of the disease in England, where the perfect stage of the fungus (*Fabraea*) [*maculata*: *R.A.M.*, xvii, p. 507; xviii, p. 259] has not yet been observed. Briefly discussing the complex problem of physiologic specialization in *F. maculata*, the writer thinks the available evidence points to the inclusion of the strains on different hosts within the one species, with

the possible exception of that occurring on *Crataegus*. The medlar strain is not definitely known to be transmissible to other hosts, but probably any one of the three fruits, quince, medlar, and pear, is a potential source of infection of the other two.

WORMALD (H.). **The Septoria leaf-spot disease of Black Currants.**—*Gdnrs' Chron.*, civ, 2711, pp. 424–425, 6 figs., 1938.

Mycosphaerella ribis, also known [by the earlier name] as *M. grossulariae* [*R.A.M.*, xvii, p. 331], was observed in the conidial stage (*Septoria ribis*) in North Wales in August, 1938, causing severe infection of black currants and destroying large areas of the leaf surface. The symptoms and life-history of the fungus are briefly described in popular terms, with special reference to the differentiation of the resultant leaf spot from the more common one due to *Pseudopeziza ribis*.

HEWITT (W. B.). **Leaf-scar infection in relation to the Olive-knot disease.**—*Hilgardia*, xii, 1, pp. 41–72, 2 figs., 2 diags., 4 graphs, 1938.

In experiments on the infection of leaf scars with the olive knot organism (*Bacterium* [*Pseudomonas*] *savastanoi*) [*R.A.M.*, xvi, p. 548], carried out during 1935 to 1937 in an orchard in Sacramento County, California, on the Mission variety, 225 out of 241 knots which developed on tagged branches were situated on leaf scars, and 229 out of 339 leaf scars, exposed by removing yellow leaves nearly ready to fall, developed knots.

When the base of the petiole of a number of leaves was inoculated on two different dates before leaf fall with a water suspension of *P. savastanoi*, only two out of 50 and two out of 67 leaf scars, respectively, developed knots, indicating that natural infection of leaf scars rarely occurs before leaf fall. A microchemical and histological examination of the abscission zone before and after leaf fall showed that no protective layers are formed before the separation of the leaf, so that at leaf fall the scar is an open wound with exposed tissues and open vessels. During the healing process a wound gum layer is formed followed by the development of a periderm. Inoculations of leaf scars made immediately after leaf fall produced a high incidence of infection both in scars kept in a moist chamber and those left outside; the susceptibility decreased rapidly during the first day after leaf fall, and was entirely lost on the fifth and the ninth day in shoots kept inside and outside the moist chamber, respectively. It is assumed that under normal weather conditions in California about 80 to 95 per cent. of the leaf scars would be susceptible to infection at the time of leaf fall, 40 per cent. on the fourth day, while most scars would be immune by the end of the ninth day.

India ink applied to fresh leaf scars penetrated comparatively deeply into the vessels of the scar, while in scars half-an-hour old it penetrated only a short distance, and the depth of penetration thereafter decreased with the increasing age of the scar. It is concluded from these results that the high percentage of infection in scars inoculated immediately after the removal of the leaves may result from the deep penetration of the inoculum at that time. Most infections in the leaf scars were

caused by bacteria that entered the tissues through vessels, whence they were liberated into the other tissues of the scar when the developing periderm pulled the vessels apart. Bacteria entering the leaf scar tissue through intercellular spaces progressed slowly and were stopped by wound gum that plugged these spaces. The bacteria formed pockets in the tissues derived from the phellogen, and the greatest amount of cell division occurred in the region of these bacterial pockets.

REICHERT (I.) & HELLINGER (ESTHER). **Dothiorella rot of Bananas and Oranges in Palestine.**—*Palest. J. Bot.*, R Ser., ii, 1, pp. 79–88, 1 pl., 1938.

A full description is given of a banana disease of some economic importance attributed to a species of *Dothiorella* observed for the first time towards the end of 1929 in the Jaffa-Tel Aviv district of Palestine [a preliminary account of which appeared in Wardlaw's book on banana diseases (pp. 260–263): *R.A.M.*, xiv, p. 322]. It is a typical tip-end rot, slowly progressing towards the stem end. The blackening of the decayed parts is preceded by a narrow, brown, watery margin forming a sharp line of demarcation between sound and infected tissues. The spores are forcibly expelled *en masse* and remain as a fine particle of white powder above each pycnidium, constituting a characteristic feature of the disease. The thick-walled, globose, black pycnidia of the fungus measure 141 to 323 by 414 to 242 μ and contain ovoid or fusoid, hyaline, thin-walled spores, 13 to 21 by 4 to 7 (average 16 by 5) μ. The rot is most prevalent under the humid conditions of winter, but may also occur to a limited extent at higher temperatures, successful inoculations having been made in June at 25° to 27° C.

At the close of the 1930–1 orange season a black rot of the fruits closely resembling that due to *Diplodia* [*natalensis*] was observed. Isolation experiments on potato dextrose agar resulted in the development of pycnidia and spores of a *Dothiorella* agreeing in essentials with that from banana, and also of sporocarps, 435 to 500 by 340 to 450 μ, embedded in black, raised, hard stromatic masses and in some cases containing asci, each occupied by eight spores, 14·5 to 19 by 5 to 8·5 (15 by 6·8) μ. Reculturing the fungus yielded only the perithecial stage. The banana species, cross-inoculated on green orange, produced a black rot macroscopically indistinguishable from that caused by *Diplodia natalensis*, but typical *Dothiorella* pycnidia were formed on the fruits. The orange *Dothiorella* caused a decay of bananas in moist chambers agreeing in all respects with that of the same fungus from banana, the pycnospores on the fruit measuring 12 to 20 by 3·5 to 6 (16 by 5) μ.

Discussing at some length the taxonomic position of the *Dothiorella* on banana and morphologically similar species recorded on citrus and other fruits, the writers conclude that all are closely related to *D. gregaria*, the imperfect stage of *Botryosphaeria ribis* [ibid., xv, p. 238; xviii, p. 148]. The perfect stage of the Palestine citrus *Dothiorella* is also nearly allied morphologically to *B. ribis*, but differs from the latter in its failure to develop a pink coloration on starchy media.

Control measures, based on plant sanitation and the use of an ammoniacal copper carbonate spray, are briefly indicated.

Hirai (T.). **Studies on the Sclerotium disease of Bananas.**—*Ann. phytopath. Soc. Japan*, viii, 3, pp. 212–229, 3 figs., 1938. [Japanese, with English summary.]

Comparative studies of the strain of *Corticium centrifugum* isolated from bananas [*R.A.M.*, xviii, p. 41] and five others derived from various plants indicated a closer relationship between the first-named and the rocambole [*Allium scorodoprasum*] strain than between the banana and clover isolates. Both the hyphae and sclerotia of the fungus are capable of attacking wounded or uninjured banana fruits under favourable conditions. The optimum temperature for sclerotial germination seemed to lie within the wide range from 24° to 36° C.; the process requires a relative atmospheric humidity exceeding 97 per cent., this factor being of greater importance than temperature in the writer's tests. Mycelial growth was most profuse between 28° and 32°, declined considerably at 20°, and practically ceased round about 11°, so that the maintenance of this temperature in the refrigerator, as in the case of other transport diseases of banana [loc. cit.], is likely to prove an effective means of control.

Magee (C. J.) & Foster (E. P.). **Banana leaf spot. Summer treatment gives promising results.**—*Agric. Gaz. N.S.W.*, xlix, 12, pp. 662–664, 1 fig., 1938.

Under the conditions prevailing in New South Wales, fair to good control of banana leaf spot (*Cercospora musae*) [*R.A.M.*, xviii, p. 192] with normal maturation of the bunches was given by Bordeaux mixture (1–1–10) with agral III spreader in mid-January and February, mid-January and April, mid-December, February, and April, and by copper-lime dust (20–80) applied each month from mid-December to mid-April, while excellent control resulted from monthly applications of Bordeaux mixture (1–1–10) and agral III from mid-December to mid-April, there being practically no spotting present. In another locality, monthly applications of Bordeaux mixture (1–1–10) with agral III from mid-December to mid-April also gave excellent control. The same treatment applied in a third locality on 29th January and 28th February, 29th January and 28th April, fortnightly from mid-December to 11th May (8 applications), monthly from mid-December to 11th May, and on 22nd December, 1st March, and 5th May in all cases gave control, the results being excellent in the case of the fortnightly and monthly spraying. In all three tests the unsprayed controls showed medium to severe infection.

These results show that under the local conditions banana leaf spot can be controlled by fungicidal applications in summer. Almost complete absence of leaf-spotting results from five applications of Bordeaux mixture at monthly intervals, or from fortnightly applications. Two sprays at an interval of one or two months, beginning in mid-December, will suffice to give practical control.

Thompson (A.). **A root disease of the Durian tree caused by Pythium complectens Braun.**—*Malay. agric. J.*, xxvi, 11, pp. 460–464, 1 pl., 1938.

In 1938, about 50 durian trees (*Durio zibethinus*) on a small estate

in Singapore became affected, singly and in groups, by a root disease due to *Pythium complectens* [cf. *R.A.M.*, xvii, p. 294], a number shortly afterwards succumbing. Severely affected trees showed a brown discoloration and decay of the bark at and just above soil-level, but no definite symptoms of patch canker [*Phytophthora palmivora*: ibid., xiv, p. 46]. In early stages, the upper lateral roots were healthy, but the lower laterals showed a decay on one side extending from the tips along the cortex and wood to the tap root. In later stages, the decay had spread to the tap root and was about to 'ring' the cortical tissue at the collar; the wood was dry, soft, pinkish, and flecked with brown.

Inoculations of wounded stems and wounded and sound roots of healthy durian trees gave positive results, the fungus being reisolated from the cortex and wood. The progress of the fungus was slower in roots than in the stem inoculations. It is considered that the fungus is a facultative parasite of roots growing in a soil of reduced fertility.

Control measures recommended consist in extirpating and burning the affected trees, removing the lateral roots, and isolating the affected areas by trenching. The lateral roots of trees adjacent to diseased trees should be inspected, and any cut ends protected with a wound dressing. Cattle manure, compost, or organic matter should be incorporated with the soil when filling in the trenches preparatory to replanting.

CARNEIRO (J. G.). **Nomenclatura phytopathologica e mycologica brasileira.** [Brazilian phytopathological and mycological nomenclature.] —Reprinted from *Bol. Agric., S. Paulo, 1937*, 51 pp., 1938. [Received February, 1939.]

An alphabetical list, intended to supplement that compiled in 1931 by E. Rangel [*R.A.M.*, x, p. 743], is given of a number of Latin and other foreign terms in current use in Brazilian phytopathological and mycological literature, with their Portuguese equivalents.

DOYER (LUCIE C.). **Manual for the determination of seed-borne diseases.** —59 pp., 33 pl. (18 col.), International Seed Testing Association (H. Veenman & Zonen, Wageningen, Holland), 1938. Fl. 5.

This clearly written and attractively presented manual on the methods of determination of seed-borne diseases of agricultural, kitchen-garden, horticultural, and miscellaneous crops employed at the Dutch State Seed Testing Station is divided into two parts, general and special. The former comprises generalities on the technique of macroscopic and microscopic examination and on the control of superficial seed-borne infection by cleaning or disinfection, while the special part deals at greater length with individual diseases and pests of the various crops under discussion. A table is appended showing the infections to be determined by (*a*) direct inspection of the original dry samples (in part), (*b*) observation of the seeds or seedlings in germination beds, and (*c*) shaking the seeds in water or other liquids. Particular mention should be made of the exceptionally good coloured and photographic reproductions accompanying the volume in the form of loose plates.

BARSS (H. P.). **Danger in unguarded seed importation.**—*Phytopathology*, xxviii, 12, p. 939, 1938.

Notwithstanding various attempts to enlighten the agricultural public

on the risks attendant on indiscriminate seed importation [*R.A.M.*, xi, p.386 *et passim*], the importance of this means of spreading dangerous plant diseases is not generally recognized. As a recent example of potentially grave significance may be mentioned the detection of a new cotton anthracnose (*Colletotrichum* sp.) in Manchukuo (*J. Sapporo Soc. Agric. For.*, xxix, pp. 27–45, 1938), the introduction of which into the United States might well lead to serious consequences. Two such introductions already causing damage are mint anthracnose [*Sphaceloma menthae*: ibid., xvii, p. 485] and potato tuber ring rot and wilt [*Bacterium sepedonicum*: ibid., xviii, p. 53].

PFANKUCH (E.) & KAUSCHE (G. A.). **Über Darstellung, Eigenschaften und quantitative Bestimmung von Tabakmosaik-Virus und Kartoffel-X-Virus und ihre physikochemische Differenzierung.** [On the preparation, properties, and quantitative determination of the Tobacco mosaic and Potato X viruses and their physico-chemical differentiation.]—*Biochem. Z.*, ccxcix, 5–6, pp. 334–345, 3 figs., 1 graph, 1938.

This is a fully detailed, tabulated account of the writers' work in the development of highly purified preparations of the tobacco mosaic and potato X viruses, the essential features of which have already been noticed from other sources [*R.A.M.*, xvii, p. 832].

ALLINGTON (W. B.). **The separation of plant viruses by chemical means.**—*Phytopathology*, xxviii, 12, pp. 902–918, 3 figs., 1938.

Of 35 chemical compounds tested for their inactivating effect in one hour at 20° C. on the viruses of tobacco mosaic (tobacco virus 1), cucumber mosaic, potato ring spot [*R.A.M.*, xvii, p. 544], potato veinbanding, tobacco ring spot [ibid., xviii, p. 61], and tobacco streak [ibid., xvii, pp. 210, 274], the following were amongst the most powerful: mercuric chloride (minimum concentrations for total inactivation over 3, 0·8, 0·1, 0·5, 0·6, and 0·1 per cent., respectively), silver nitrate (4, over 2, 1, 0·5, 1, and over 1), copper sulphate (over 6, 1·8, 2, 2·5, 1, and 0·2), lithium carbonate (over 1, usually 1, 1, over 1, 1, and 1), phenol (usually 5, 5, usually 5, 5, 4, and 2), formalin (over 50, 1, 1, 1, over 0·5, and 1), nitric acid (2, 0·6, 0·4, 0·9, 0·3, and 0·5), sodium hydroxide (0·3, 0·2, 0·1, 0·3, 0·2, and over 0·1), sodium permanganate (usually 1·5, 0·5, 0·1, 1, 0·5, and 0·2), and potassium permanganate (1·5, 0·4, 0·4, 0·8, 0·2, and 0·2).

On the basis of their differential reactions to chemical treatment, it was possible to separate the two components of four virus mixtures, viz., cucumber mosaic and potato ring spot (by silver nitrate, mercuric chloride, potassium permanganate, copper sulphate, and lithium carbonate at appropriate dilutions), potato ring spot and potato veinbanding (by mercuric chloride, potassium permanganate, sodium hydroxide, and nitric acid), cucumber mosaic and tobacco ring spot (by mercuric chloride and phenol), and tobacco mosaic (1 in 100) and tobacco ring spot (by phenol and sodium permanganate).

LEVADITI (C.). **Les ultravirus.** [The ultra-microscopic viruses.]—*Bull. Soc. Enc. Industr. nat., Paris*, cxxxvii, 1–2, pp. 27–42, 1938.

In this well-informed and fully documented survey of the ultra-

microscopic virus problem, the author critically discusses some important points connected with the properties (pathogenicity, filterability, reaction to chemical agents, dimensions, and so forth) and nature of viruses and bacteriophages.

McComb (A. L.). **The relation between mycorrhizae and the development and nutrient absorption of Pine seedlings in a prairie nursery.** —*J. For.*, xxxvi, 11, pp. 1148–1154, 3 figs., 1938.

In 1937 a new tree nursery was established at Ames, Iowa, on an area that had been farmed for many years, situated on O'Neil sandy loam soil with a gravel subsoil. Various species of pine were included in the coniferous section (P_H 6 to 6·2), four of which, northern white pine (*Pinus*) [*strobus*], *P. ponderosa*, Japanese red [*P. densiflora*], and Virginia (*P. virginiana*), were mulched with pine needles from an adjacent plantation. In the middle of the first growing season many of the seedlings turned brown to reddish-purple and entirely ceased growth, and on examination of their roots mycorrhiza were found to be lacking. A comparative study was made of the mycorrhizal and non-mycorrhizal seedlings of *P. virginiana* and the following data obtained. The average height from the root collar to bud of 20 seedlings furnished with mycorrhiza was $2{\cdot}70 \pm 0{\cdot}09$ in. compared with $2{\cdot}00 \pm 0{\cdot}06$ for the same number without mycorrhiza, the corresponding total numbers of short roots being 672 ± 32 and 304 ± 15, respectively. The average green and dry weights of samples of mycorrhizal seedlings were, respectively, $1{,}230 \pm 6{\cdot}1$ and $323 \pm 5{\cdot}7$mg. and for non-mycorrhizal seedlings $592 \pm 13{\cdot}6$ and $152 \pm 4{\cdot}2$ mg. The average nitrogen, phosphorus, and potassium contents per plant of the mycorrhizal series were $5{\cdot}75 \pm 0{\cdot}17$, $0{\cdot}60 \pm 0{\cdot}02$, and $2{\cdot}17 \pm 0{\cdot}07$ mg., respectively, compared with $2{\cdot}87 \pm 0{\cdot}08$, $0{\cdot}15 \pm 0{\cdot}004$, and $0{\cdot}96 \pm 0{\cdot}04$ mg., respectively, in the non-mycorrhizal. From these figures it is concluded that the differences in plant development were due to disparities in the amounts of available phosphorus, and that the mycorrhiza were the means of enabling the seedlings to absorb this element at a sufficiently rapid rate for normal growth [cf. *R.A.M.*, xvii, p. 698].

Rivera (V.). **Der chemische Faktor beim Parasitenbefall der Pflanzen.** [The chemical factor in the parasitic infection of plants.]—*Angew. Chem.*, li, 44, p. 775, 1938.

This is an abstract of a paper read before the Tenth International Congress of Chemistry in Rome (15th to 21st May, 1938). Although chemical factors are predominantly involved in the susceptibility of plants to fungal, bacterial, and virus infection, no general rule can be laid down concerning their operation, which varies with the individual host and pathogen [cf. *R.A.M.*, ix, p. 472 *et passim*]. Thus, in one case sugars are mainly responsible, in another nitrogen or soluble polypeptids, while the ability of the host to supply the invading organism with a sufficiency of these substances must also be taken into consideration. Cell sap acidity sometimes enhances and in other cases reduces susceptibility. In experiments cadmium, lead, barium, strontium, picric acid, and strychnine, as well as the contact metals, were shown to exert either a stimulatory or an inhibitory action on parasitic attack.

The defence mechanism of plants against invasion is frequently of a chemical nature, being sometimes connected with the presence (actual or incipient) of phenol compounds, in other cases with that of tannin, while yet again the juice of resistant plants may contain substances of which the antitoxic and bactericidal efficacy is bound to the protein portion.

Robbins (W. J.) & Kavanagh (F.). **Thiamin and growth of Pythium butleri.**—*Bull. Torrey bot. Cl.*, lxv, 7, pp. 453–461, 3 figs., 1938.

The authors state that in the light of present knowledge the fungi may be divided into at least three groups by their relation to thiamin (vitamin B_1), according to whether they are able or not to synthesize thiamin or the vitamin intermediates pyrimidin and thiazol [*R.A.M.*, xviii, p. 185], and to their growth response to the addition of thiamin or the vitamin intermediates to the culture media. The results of experiments, in which *Pythium butleri* [ibid., xvii, p. 522] was cultured in solutions of different concentrations of salts, asparagin, and dextrose, and also in the absence of organic nitrogen, showed that in the concentrated mineral salts solution containing asparagin and sugar the growth of the fungus was negligible, but was markedly increased on the addition of thiamin or pyrimidin. It was capable of unlimited growth when the salts of the solution were diluted, and the growth was also increased in this solution by the addition of thiamin or pyrimidin. In one instance the contamination of the medium by bacteria increased the growth of *P. butleri*. The fungus was further shown to be able to synthesize thiazol and smaller amounts of pyrimidin. These results are interpreted as indicating that under the conditions of the experiments the amount of thiamin formed by *P. butleri* was the factor limiting growth, and that the production of thiamin was affected by the concentration of salts in the solution. *P. butleri* differs from all the three groups of fungi mentioned above in that its rate of growth was increased by the addition of thiamin or pyrimidin independently of whether it was able or not under the conditions of the experiment to produce thiamin or the vitamin intermediates, whereas among the three groups the addition of the growth supplements is beneficial only in the case of the fungi that do not produce these substances, and does not affect or inhibits the growth of those which synthesize them.

Dorst (J. C.). **Over het kweekveld der Friesche maatschappij van landbouw te Engelum.** [On the breeding field of the Friesian Agricultural Society at Engelum.]—*Tijdschr. PlZiekt.*, xliv, 6, pp. 277–279, 1938.

Notes are given on breeding work carried out since 1921 at Engelum, Holland, against potato wart [*Synchytrium endobioticum*], and the two serious flax diseases, 'black tip' (due to the teleutospore stage of *Melampsora lini*) and 'fire' [*Pythium megalacanthum, Asterocystis radicis*, and other fungi: *R.A.M.*, xi, p. 182], to both of which the Concurrent variety has shown resistance. Roughly 90 per cent. of the total Dutch area under potatoes consists of the susceptible varieties, Eersteling [Duke of York], Bintje, Eigenheimer, Zeeuwsche Blaue, and Thorbecke, and their replacement by resistant strains presents a most

complex problem. In the course of propagating by asexual means a collection of potato bud mutants, some have suddenly acquired resistance to certain diseases, e.g., *Phytophthora* [*infestans*] and scab [*Actinomyces scabies*]. Judging by the results of crossing experiments, some of these mutations appear to be of an hereditary character.

BOTJES (J. G. O.). **Over het phytopathologische werk op zijn bedrijf.** [On the phytopathological work on his farm.]—*Tijdschr. PlZiekt.*, xliv, 6, pp. 265–276, 1938.

In the present paper the author gives an account of studies of potato diseases carried out on his farm, situated on reclaimed marsh land at Oostwold, Holland, reference to which has been made from time to time in this *Review*.

VAN SCHREVEN (D. A.). **Over verschijnselen van boriumgebrek bij Aardappelknollen zooals deze zich openbaren op het veld.** [On boron deficiency symptoms in Potato tubers as manifested in the field.]—*Tijdschr. PlZiekt.*, xliv, 6, pp. 289–296, 2 pl., 1938. [English summary.]

Among Red Star potatoes in a field belonging to the Dutch Sugar Beet Cultivation Institute where heart rot of fodder beets was severe from 1935 to 1937, a tuber disease characterized by partial or total brown discoloration of the vascular ring was distinctly less prevalent in 1938 in plots receiving Chilean sodium nitrate (600 kg. per hect.) than in those treated with the same quantity of calcium nitrate. In a second field planted with the Industrie variety the fertilizer consisted of 1,200 kg. ultra super (20 per cent.), 1,000 kg. potash fertilizer, and 500 kg. nitrogen in various forms plus 20 kg. borax. Of 157 tubers from the former field sectioned at harvesting, 99 (63 per cent.) showed internal symptoms of disease, while of 116 from the latter only 18 (16 per cent.) were similarly affected in a comparatively mild form.

The vascular discoloration associated with absence of boron [*R.A.M.*, xvi, pp. 55, 269] is usually most pronounced at the navel ['stem'] end of the tubers, beginning at the point of insertion of the stolon. The portions of the cortex adjoining the vascular ring may participate to some extent in the darkening of the tissues, while the pith may also occasionally be involved. The area enclosed by the vascular ring may present a somewhat glazed appearance in severely affected tubers, which may emit a slight creaking sound on cutting. Moreover, the diseased tissues tend to develop a rapid discoloration on exposure to the air.

LORING (H. S.). **Properties of the latent mosaic virus protein.**—*J. biol. Chem.*, cxxvi, 2, pp. 455–478, 1 fig., 1 graph, 1938.

The results of experiments to determine the yields and relative or specific activity of the latent [potato] mosaic (X) virus obtained from *Nicotiana glutinosa* and Turkish tobacco [*R.A.M.*, xvii, p. 207], and prepared by chemical treatment and ultracentrifugation, revealed wide variations in relative activity according to the method of purification employed. In general, repeated precipitation with salt or acid produced preparations of low and variable activity, as compared with the uniform

high activity displayed by those resulting from ultracentrifugation. There were no marked differences in the properties of the active and relatively inactive preparations, both having the same qualitative solubility, serological relations, ability to traverse ultrafilters of about 450 mμ average pore diameter when dissolved in nutrient broth and 0·1 M phosphate at P_H 8·5, and capacity for the formation of liquid crystalline solutions, which are, however, more opalescent in the case of the inactive preparations and give highly diffuse boundaries in the analytical ultracentrifuge.

The analyses of virus purified by ultracentrifugation are those of a nucleoprotein containing some 6 per cent. nucleic acid. Qualitative tests and the isolation of a material with the qualitative solubility of yeast nucleic acid also point to the presence of a pentose nucleic acid. The ratio of carbohydrate to phosphorus is about twice that determined by the same analytical method for yeast nucleic acid, indicating the possible occurrence of carbohydrate in some other form as well as in combination with nucleic acid. The latent mosaic virus is relatively unstable below P_H 4, but stable from 7·5 to 9, in diametrical opposition to tobacco mosaic.

The relatively high degree of homogeneity of the virus purified by the ultracentrifugation of clarified infectious juice, as shown by its uniform specific activity and the sharp boundaries obtained in the analytical ultracentrifuge, and its ability to pass ultrafilters of 450 mμ pore diameter, are considered to indicate that such preparations, as opposed to those derived from ammonium sulphate treatment, are essentially identical with the infectious principle as it occurs in plant juice.

Black (L. M.). **Properties of the Potato yellow-dwarf virus.**—*Phytopathology*, xxviii, 12, pp. 863–874, 2 figs., 1938.

At the Rockefeller Institute for Medical Research, Princeton, New Jersey, the potato yellow dwarf virus [*R.A.M.*, xvii, p. 701] was experimentally transmitted by means of grafting or the leaf-hopper vector, *Acerotagallia sanguinolenta*, to the following plants not hitherto recorded as susceptible: *Nicotiana glutinosa*, *N. langsdorffii*, *N. sylvestris*, Semple's Shell Pink China aster (*Callistephus chinensis*), crimson clover (*Trifolium incarnatum*), broad bean, *N. rustica* (also inoculated by rubbing), *N. glauca*, *N. paniculata*, *N. sanderae*, Turkish tobacco, *Physalis pubescens*, and Black Beauty eggplant. In all cases the virus was transferred back from the new host to Green Mountain potatoes or *N. glutinosa*.

Up to 1,350 primary lesions were obtained on a single half leaf of *N. rustica* inoculated with the yellow dwarf virus from the same host, the foliage in some cases being so heavily infected that complete yellowing rapidly ensued. The English, Iowa, *jamaicensis*, *pumila*, and Winnebago varieties of *N. rustica* are all susceptible to the yellow dwarf virus, while *N. paniculata* and *N. undulata*, descendants of the probable parental species of *N. rustica*, also respond to inoculation by the development of primary lesions. In inoculation tests by the carborundrum method of leaf-rubbing *N. rustica* proved to be more susceptible to infection by the yellow dwarf virus than any of the five plants

from which the inoculum was procured, viz., potato, *N. glutinosa*, Turkish tobacco, *Hyoscyamus niger*, and crimson clover. Experiments undertaken to determine the best method of mechanical transmission in the potato showed that the most satisfactory results (50 per cent. infection) were secured by placing juice from severely diseased leaves round the eye of an unsprouted seed piece and making about 100 pin punctures through the juice into the flesh of the tuber.

The primary-lesion reaction was applied in the determination of certain properties of the virus, which was found to succumb in the juice of *N. rustica* after 2½ to 12 hours' exposure to room temperature (23° to 27° C.) and did not survive a week's desiccation in leaves of the same host in the laboratory. It was, however, consistently recovered from infective *N. rustica* juice diluted 10^{-3} (and in one instance 10^{-5}) with phosphate buffer or healthy juice. The virus was inactivated at a temperature of about 50°. It passed through a Berkefeld W filter without loss of virulence.

Grechushnikoff [Gretschushnikoff] (A. I.). Значение систоамилазы в иммунитете Картофеля к **Phytophthora infestans De Bary.** [The significance of sistoamylase in the resistance of Potato to *Phytophthora infestans* de Bary.]—*ex* Symposium dedicated to the memory of V. N. Lubimenko, pp. 309–313, Ukr. S.S.R. Acad. Sci. Press, Kieff, 1938. [English summary.]

The results of the experiments described in this paper are stated to have again shown that the foliage of potato varieties resistant to late blight (*Phytophthora infestans*) contains considerably larger amounts of sistoamylase [*R.A.M.*, xvii, p. 551] than that of susceptible ones; in a further series, in which a highly susceptible (Early Rose) and a resistant (Smyslovski) variety were artificially infected with *P. infestans*, it was found that infection was followed by a marked drop in the sistoamylase content of both varieties, the amount of the substance being actually lower in the healthy than in the diseased areas of infected leaves. Still further experiments, carried out both in pots and in the field, demonstrated that in all the varieties of cultivated potatoes and species of wild potatoes and their hybrids that were tested, the amount of sistoamylase was highest in dry soil (20 per cent. saturated) and gradually decreased as the soil moisture was increased. The fact, however, that no infection resulted in the blight-resistant No. 8670 variety at the higher soil humidities, at which its sistoamylase content was reduced to a lower level than in Early Rose, is considered to indicate that resistance to blight is not determined by the sistoamylase factor alone.

Mills (W. R.). **The influence of maturity of Potato varieties upon their susceptibility to late blight.**—*Amer. Potato J.*, xv, 11, pp. 318–325, 1938.

The artificial inducement of maturity in five potato varieties, viz., Bliss Triumph, Green Mountain, Katahdin, Smooth Rural, and 215–34 (a cross between Evergreen and Ekishirazu), by curtailing the period of exposure to daylight from the normal 13 to 14 hours (March) to 9 failed to increase susceptibility to late blight (*Phytophthora infestans*)

[cf. *R.A.M.*, vi, p. 47; xiii, p. 724 *et passim*]. The only significant change observed was the decreased susceptibility of short-day Smooth Rural plants as compared with those receiving the normal supply of light.

IMURA (J.). **On the influence of sunlight upon the lesion enlargement of the Helminthosporium disease of Rice seedlings.**—*Ann. phytopath. Soc. Japan*, viii, 3, pp. 203–211, 1938. [Japanese, with English summary.]

The writer investigated the influence of sunlight on the enlargement of *Helminthosporium* [*oryzae* = *Ophiobolus miyabeanus*: *R.A.M.*, xvii, pp. 768, 769] lesions on rice seedlings by similar methods to those already described in connexion with his studies on blast [*Piricularia oryzae*: ibid., xvii, p. 767]. In the early stages of illumination the expansion of the spots seemed to reach a maximum on the seedlings kept under the darkest conditions (covered with two sheets of black cloth) and to be least active on those in uncovered boxes or cages. At a more advanced stage the process was most intense in the medium-shaded boxes (one or two white cotton sheets). As in the case of *P. oryzae*, the growth of *O. miyabeanus* in culture media tends to be retarded by sunlight. The relation of sunlight to lesion enlargement in the late stages of *Helminthosporium* disease is shown by these experiments to be analogous to the early reaction of the blast fungus to illumination.

BEELEY (F.). **Oidium heveae. Report on the 1938 outbreak of Hevea leaf-mildew.**—*J. Rubb. Res. Inst. Malaya*, viii, 3, pp. 232–240, 1 graph, 1938.

In contrast to previous years [*R.A.M.*, xvii, p. 414], the *Hevea* rubber trees in the southern and central districts of Malaya wintered well in 1938, owing to dry weather brought on by the north-east monsoon, and produced an excellent flush of new foliage comparatively free from mildew (*Oidium heveae*), while in the northern districts wintering was unusually late and refoliation was interrupted by heavy rains in late March and April, with the result that a very severe attack of mildew was experienced. The rapidity of this year's outbreak of mildew seemed to indicate that the fungus hibernates in the green buds of the terminal shoots. No gradual spread of infection from a focal point of a field of rubber was observed, but the disease appeared suddenly and simultaneously on all trees in that area of which the leaves were still immature.

HASTINGS (J. D.) & PIDDLESDEN (J. H.). **Prevention of mould growth on sheet Rubber during storage.**—*J. Rubb. Res. Inst. Malaya*, viii, 3, pp. 250–257, 1938.

The problem of preventing mould development on stored rubber sheets [*R.A.M.*, ix, p. 337] is stated to have become particularly important since recent arrangements have permitted estates to store larger stocks of rubber during periods of low export releases. The growth of mould in storage is favoured by the following factors: residual hygroscopic serum bodies in the rubber, the packing of imperfectly dried rubber, insufficient smoke substances in the dry sheet, centres of infec-

tion, and damp storage conditions. The rubber must be packed very dry: it should, therefore, not be removed from the smoke house during wet weather or before the sun is well up, and should be packed before evening in cases thoroughly dried by the sun. Since it has been found in practice that some of the smoke substances absorbed by the rubber have a strong preservative action and that generally a deeper coloured sheet is more resistant to mould, the smoke house should be adjusted to give as dark a sheet as possible. Smoked sheets should be stored under the driest possible conditions, opened up during the day to ensure ventilation, and closed at night to exclude the damp air. Any defective sheets found at the inspection just before shipping should be reconditioned by scrubbing them in paranitrophenol solution and then drying them in the smoke house.

Paranitrophenol is recommended as the most suitable preservative for incorporation with the rubber. Soaking the freshly machined sheets in a bath of the solution, taking care that both surfaces of each sheet are thoroughly wetted, has been found in practice to be very efficient and cheaper than adding the preservative to the latex. Many estates reported bubbles and blisters on sheets resulting from paranitrophenol treatment, and the results of experiments undertaken to investigate this point confirmed the opinion that rubber was made more sensitive to heat by the addition of paranitrophenol to the latex, and also by the sodium sulphite used on many estates to avoid pre-coagulation. Sheets containing paranitrophenol and kept in hot air at 120° F. for 24 hours and then at 140° till dry showed only a few small bubbles, while those dried at 140° throughout were very badly blistered. Sheets soaked in paranitrophenol solution exhibited a similar but less pronounced sensitivity. It is concluded, therefore, that sheets containing or soaked in paranitrophenol should be dried in the smoke house at moderate temperatures, particularly at first, the disadvantage of slow drying being fully compensated by the production of a darker sheet more resistant to mould attack.

PARK (M.) & FERNANDO (M.). **The nature of Chilli leaf-curl.** *Trop. Agriculturist*, xci, 5, pp. 263–265, 2 figs., 1938.

A leaf malformation of chilli (*Capsicum frutescens*), included under the name leaf curl [*R.A.M.*, xiii, p. 219], is described as it occurs at Peradeniya, Ceylon: the leaf blade is curled towards the abaxial side, the interveinal areas of the leaf are sometimes distorted, and a partial suppression of the lamina, especially near the petiole, may be observed, resulting in the formation of narrow strap-shaped leaves. In advanced stages of the disease the apical meristem is aborted, and the axillary buds produce clusters of minute, thickened, and brittle leaves. Severely affected plants usually do not flower, and fruits, if they appear, are truncated or curled at the stylar end. Though leaf curl has hitherto been ascribed to viruses in Ceylon, no evidence in support of this view was forthcoming, whereas diseased plants protected from insects developed normally. Whilst the possibility of a virus being implicated is not entirely excluded, the disease is thought more probably to be due to insect injury.

Bell (A. F.). **Report of the Division of Entomology and Pathology.**— *Rep. Bur. Sug. Exp. Stas Qd, 1937–38*, pp. 41–50, 1938.

In this report [cf. *R.A.M.*, xvii, p. 66] it is stated that sugar-cane gumming disease (*Bacterium vasculorum*) as a direct economic factor is now confined to the Mulgrave Mill area in northern Queensland. With the elimination of many of the S.J. 4 canes in the originally quarantined area the intensity of the disease has greatly diminished. A slow, outward spread still occurs, however, and the growing of S.J. 4 and Clark's Seedling has, therefore, been forbidden throughout the entire mill area. Of new seedlings tested, Q.10 appears to show most promise. A wide range of plants, when artificially inoculated, are able to act as hosts to the gumming disease organism, including sweet and dent maize, sweet and grain sorghum, Sudan grass [*Sorghum sudanense*: ibid., xv, p. 211], Guinea grass [*Panicum maximum*], Para grass [*Brachiaria mutica*], *S. verticilliflorum*, elephant grass [*Typha elephantina*], and Johnson grass [*S. halepense*]. Some varieties of sorghum were highly susceptible, the stalks freely oozing gum six months after inoculation.

A serious outbreak of Fiji disease [ibid., xvii, p. 627] occurred in the Bundaberg area in January, 1938, and small outbreaks occurred near the Elliott river and in the Isis area; in the last-named P.O.J. 2878 constitutes over half the crop.

In further tests of the hot-water treatment, the causal organism of chlorotic streak [ibid., xvii, pp. 67, 345] was inactivated by exposure to a temperature as low as 45° C. Affected plants are favoured by *Aphis sacchari*, even very small diseased plants often showing heavy infestation, which is later followed by a dense growth of sooty mould [loc. cit.].

Observations indicated that both E.K. 28 and P.O.J. 2878 are susceptible to dwarf disease [ibid., xvi, p. 61].

Downy mildew [*Sclerospora sacchari*: ibid., xvii, p. 627] considerably affected plantings of P.O.J. 2878 in the Mackay district, and the further growing of this variety has been prohibited. The disease has increased on the same variety in the Bundaberg area, and to a less extent on P.O.J. 213, which is resistant to Fiji disease. As both varieties are widely grown in southern Queensland, every effort is being made to clear up the outbreak.

Rind disease (*Pleocyta sacchari*) [ibid., xvii, p. 66] was an important economic factor in a large part of Queensland during the spring of 1937. S.J. 4 in the Cairns-Mossman area, 1900 Seedling at Mackay, and P.O.J. 2878 in the Bundaberg-Isis area were particularly affected, the losses totalling some thousands of tons of cane. The different isolates showed a broad range of variation in morphology, which did not, however, appear to be associated with any difference in virulence.

The top rot stage of red stripe disease [*Bact. rubrilineans*: ibid., xvi, p. 127] was not favoured by seasonal conditions except in the Mackay district, where it caused some damage to 1900 Seedling and P.O.J. 2714. Experimental evidence indicated that Q. 2 is highly resistant, and Q. 10 and Q. 19 are reasonably so.

Leaf scald [*Bact. albilineans*: ibid., xvii, p. 487] was noticeable only in the wet, poorly drained area between the Babinda and Mulgrave

mill areas. Infection is much affected by climatic conditions, and in areas subject to recurrent droughts persists only in highly susceptible varieties.

Rayss (T.). **Nouvelle contribution à l'étude de la mycoflore de Palestine.** [A new contribution to the study of the Palestinian mycoflora.]—*Palest. J. Bot.*, J Ser., i, 2, pp. 143–160, 6 figs., 1938.

This further critically annotated list of Palestinian fungi [*R.A.M.*, xviii, p. 204] contains three new species [with Latin diagnoses] and a number of other interesting records, of which the following may be mentioned. Club root of cabbage, kohlrabi, and cauliflower (*Plasmodiophora brassicae*) was prevalent in 1937. Cauliflower leaves were attacked in 1935 and 1937 by *Peronospora brassicae* f. *major* Săvul. & Rayss, which is characterized by conidiophores 230 to 400 by 7 to 14 μ and conidia 20 to 30 by 16 to 25 μ. *P. schachtii* occurred on beet leaves in 1937 and 1938. *P. spinaciae* was prevalent in 1935 on spinach exposed for sale in shops. *Bremia lactucae* was observed in 1937 on [wild] lettuce (*Lactuca scariola*) leaves. *Cystopus candidus* f. *brassicae nigrae* Săvul. & Rayss was observed on black mustard in 1935, *C. portulacae* on purslane (*Portulaca oleracea*) leaves and stems in 1934 and 1937, and *C. resedae* n.sp. (*C. candidus* f. *resedae* Jacz.) on living leaves of *Reseda alba* in 1938. *Medicago hispida* foliage was parasitized in 1935 by *P. săvulescui* n.sp., characterized specially by the large warts on the oospores.

Lundell (S.) & Nannfeldt (J. A.). **Fungi exsiccati suecici, praesertim upsalienses.** [Swedish fungi exsiccati, especially from Upsala.].—Fasc. IX–X (Nr. 401–500), 49 pp., 2 figs., 1937; XI–XII (Nr. 501–600), 38 pp., 1938; XIII–XIV (Nr. 601–700), 37 pp., Upsala, Almquist & Wiksells, 1938.

Among the species represented in these exsiccata, the labels of which are here reprinted in book form, the following may be mentioned. No. 79: *Stereum frustulatum* is accepted as the correct spelling for this species and not *S. frustulosum* [*R.A.M.*, xvii, p. 567], as there is no reason to reject the specific name *frustulata* of Systema mycologicum. No. 606: *Phragmidium mucronatum* [ibid., xviii, p. 184] is accepted as a valid name for the species commonly known as *P. subcorticium* or *P. disciflorum*. Finally under No. 680 *Torula maculicola* is considered to be immature *Fusicladium radiosum* [*Venturia tremulae*: ibid., xvii, p. 779].

Neurath (H.) & Saum (A. M.). **The diffusion of Tobacco mosaic virus protein in aqueous solution.**—*J. biol. Chem.*, cxxvi, 2, pp. 435–442, 2 graphs, 1938.

Diffusion measurements of the tobacco mosaic virus protein [*R.A.M.*, xviii, p. 211 and next abstracts], prepared by Stanley's chemical method [ibid., xvi, p. 211] and dissolved in 0·1 M phosphate buffer, were calculated by means of Lamm's refractometric method. The observed diffusion constant is approximately 3×10^{-8} sq. cm. per sec. in the most dilute solutions (0·2 to 0·5 per cent.). The average molecular weights computed from this value and the sedimentation constants, 200×10^{-13} and 174×10^{-13}, are about 64,800,000 and 59,000,000, respectively, corresponding to a particle size of about 14 mμ in diam. and 720 mμ in length.

LAUFFER (M. A.). **The viscosity of Tobacco mosaic virus solutions.**—*J. biol. Chem.*, cxxvi, 2, pp. 443–453, 1 graph, 1938.

From measurements of the specific viscosity of tobacco mosaic virus protein with a high precision quartz viscometer, taken in conjunction with sedimentation data, the size and shape of the tobacco mosaic virus protein molecule have been estimated. Two alternate sets of values were obtained, one corresponding to rod-like particles with a molecular weight of $42{\cdot}6\times10^6$, a diameter of 12·3 mμ and a length of 430 mμ, and the other to similar particles with a molecular weight of $63{\cdot}2\times10^6$, a diameter of 11·5 mμ, and a length of 725 mμ. Both these sets of values are of the same order of magnitude as those secured from stream double refraction, diffusion, ultrafiltration, and X-ray diffraction data. In terms of a model arbitrarily selected as having the dimensions of the former set of values, it was shown that a second component, the particles of which are formed by the end-to-end association of two rod-like molecules resembling the model, should have a sedimentation constant of 202×10^{-13} as compared with 174×10^{-13} for the original. Preparations of tobacco mosaic virus protein showing double boundaries in the ultracentrifuge have components with sedimentation constants of 174×10^{-13} and 200×10^{-13}. Both viscosity and double refraction of flow of the protein were found to increase in the region of the isoelectric point (P_H 5·5 to 4·2), but the former alone falls sharply to a minimum very near this point. Viscosity decreased on the addition of electrolytes, probably on account of the electrokinetic potential of the particles.

Aggregation of purified Tobacco mosaic virus.—*Nature, Lond.*, cxlii, 3601, pp. 841–843, 1938.

In the first of three papers under this heading, H. S. Loring, M. A. Lauffer, and W. M. Stanley state that accumulated evidence seems to indicate that aggregation and decreased specific activity in purified viruses occurred as a result of the somewhat drastic chemical methods used by Stanley and others [*R.A.M.*, xviii, p. 143] for the purification of viruses. In search of new methods of purification, the authors obtained a highly purified tobacco mosaic virus by means of high-speed centrifugation in the absence of salt, and subjected to a comparative study its activity, tested on leaves of *Phaseolus vulgaris* by the half-leaf method, its stream double refraction, and its filterability, before and after purification. It was found that one sedimentation caused neither an appreciable decrease in activity nor an increase in stream double refraction, whereas four sedimentations caused a slight decrease in activity and a significant increase in stream double refraction. Virus sedimented one or four times showed the same ability to pass ultra-filters of 190 mμ average pore diameter as the virus in the original juice. These results failed to show an appreciable irreversible aggregation as a result of centrifugation, and indicated that tobacco mosaic virus purified by a few careful centrifugations is comparable in the three properties studied to the virus in untreated juice.

F. C. Bawden and N. W. Pirie point out that even if centrifugation does not cause aggregation, completely unaggregated preparations could be expected only from plants that have been recently infected,

for aggregation occurs naturally in the sap of plants that have been long diseased. They suggest that until adequate data on the properties of virus preparations made by high-speed centrifugation have been published, their purity cannot possibly be assessed.

K. M. Smith and W. D. MacClement see no justification for the view that the virus is not aggregated merely because it passes a membrane of 190 mμ average pore diameter. They point out that the accepted ultrafiltration end point of tobacco mosaic virus in crude clarified sap is about 50 mμ; in their own experiments the end point of the virus, after precipitation at P_H 3·4, was found under optimum conditions to be 150 to 175 mμ; and finally a highly purified tobacco mosaic virus, capable of entering the liquid crystalline state, has an end point greater than 450 mμ. It is evident, therefore, that intermediate stages of aggregation are possible.

LAUFFER (M. A.). **Optical properties of solutions of Tobacco mosaic virus protein.**—*J. phys. Chem.*, xlii, 7, pp. 935–944, 4 figs., 1 diag., 1 graph, 1938.

Dilute aqueous solutions of the tobacco mosaic virus protein have been known for some time to exhibit double refraction of flow [see preceding abstracts]. The results of the present experiments show that little or no stream double refraction is obtained from the protein in solvents having a refractive index approximating to that of the protein itself (1·6), e.g., glycerol-water and aniline-glycerol-water mixtures. A slight decrease in virus activity, measured by the half-leaf method on *Phaseolus vulgaris*, was caused by a week's contact of a 10^{-6} mg. per c.c. dilution with glycerol (90 per cent.), but no significant change in activity resulted from ten minutes' contact with water or aniline.

Ultracentrifuged gelatinous pellets of the protein were shown to have properties characteristic of the liquid crystalline or paracrystalline state, a fact regarded as constituting additional evidence of the rod-like character of the mosaic virus [*R.A.M.*, xviii, p. 62]. A photomicrograph of a flattened section of such a pellet is stated to resemble substances of a known crystalline or paracrystalline nature, e.g., bromophenanthrenesulfonic acid.

The Tyndall effect of the upper of the two layers into which relatively concentrated solutions of the protein separate on standing was found to differ markedly from that of the lower. In the upper the scattered light is only slightly depolarized, whereas in the latter the degree of depolarization is much more advanced.

All these data are considered to be consistent with the conclusion that the tobacco mosaic virus protein particles or molecules are rod-shaped nucleoproteins with little or no intrinsic double refraction, in respect of which they differ markedly from the sperm cells of the cuttle-fish and cells of other living organisms having the property of double refraction or paracrystallinity.

MARTIN (L. F.) & MCKINNEY (H. H.). **Tobacco-mosaic virus concentrated in the cytoplasm.**—*Science*, N.S., lxxxviii, 2289, pp. 458–459, 1938.

The vacuole sap extracted by Chibnall's method of hydraulic pressure

(*J. biol. Chem.*, lv, p. 333, 1923) from mosaic-infected Maryland Medium tobacco leaves contained a very small amount of protein after filtration through celite. The protein was partially insoluble in 0·5 saturated ammonium sulphate and precipitated by trichloro-acetic acid. The 45 c.c. of vacuolar sap contained 0·317 mg. per c.c. of total nitrogen, and only 0·022 mg. per c.c. of protein nitrogen. Most of the protein was in the 78 c.c. of cytoplasmic extract, which contained 0·583 mg. per c.c. of total nitrogen, and 0·389 mg. per c.c. of protein nitrogen. On this basis the vacuolar sap and the cytoplasmic extract contained, respectively, 0·13 and 2·36 mg. per c.c. of protein. In inoculation experiments on primary Scotia bean (*Phaseolus vulgaris*) leaves, the vacuolar sap and the cytoplasmic extract of the mosaic tobacco foliage, diluted to a uniform protein content of 10^{-4} mg. protein per ml. in a phosphate buffer at P_H 7, induced 1 and 240 lesions, respectively, the corresponding number for a control preparation of highly purified virus protein being 222 (32 leaves each). It is evident from these data that the protein in the vacuolar sap is chiefly a non-infectious form, and it appears probable that part or all of the trace of virus in this fraction represents contamination from the cytoplasm during pressure. The mosaic virus being thus obviously localized in the cytoplasm, Livingston's theory of its passage from cell to cell through the plasmodesmata seems plausible [cf. *R.A.M.*, xvi, p. 67].

Wickens (G. M.). **Rosette disease of Tobacco: field observations and suggestions for control.**—*Rhod. agric. J.*, xxxv, 11, pp. 842–849, 1 fig., 1938.

The rosette disease of tobacco recently reported from Southern Rhodesia [*R.A.M.*, xvii, p. 565] shows two phases of infection in the field. These are a localized phase, in which small groups of affected plants are scattered about the fields, and an epidemic phase, in which infection is generally distributed.

The available evidence indicates that some wild or garden plant probably harbours the virus during winter, and that the vector (? *Myzus persicae*) picks up the virus from these plants and infects the tobacco in the following season. From these sources of infection the disease spreads generally too slowly to cause any great damage. The localized phase appears to have been common in most of the tobacco-growing areas of Southern Rhodesia, all instances of severe epidemics except one being in late-planted crops. It is assumed that the localized phase results from transmission by wingless aphids, which crawl from plant to plant, and the epidemic phase from widespread dissemination of winged, infective aphids.

It is considered that the disease should be regarded as a real danger, and growers are strongly advised to adopt the following control measures. As transmission experiments have proved seedlings to be highly susceptible, seed-beds should be frequently examined; if aphids only are present, a nicotine spray should be applied, while if rosette is present as well, every plant and aphid should be promptly destroyed. If the bed cannot be spared, the affected seedlings with the aphids attached should be removed, and destroyed, the remaining seedlings then being sprayed with nicotine; further roguing and spraying must later be

carried out as required. Frequent roguing should also be carried out during the early stages of growth. As soon as possible after all leaves of value are reaped, the infected plants should be removed and destroyed. Where possible, nicotine spraying or dusting of small areas of local aphid infestation should be attempted immediately after the removal of the affected plants.

Van der Poel (J.). **Kort overzicht van het slijmziekte-vraagstuk bij de Deli-Tabak.** [A brief survey of the slime disease problem in Deli Tobacco.]—*Meded. Deli-Proefst.*, Ser. 2, ii, pp. 5–16, 1939. [Issued 1938.]

This is a summary of outstanding contributions to the knowledge of slime disease of tobacco (*Bacterium solanacearum*) under various aspects, including bacteriological studies, breeding for resistance, and the influence of environmental conditions on the pathogen, with special reference to the experiments in its control in continuous progress at the Deli (Sumatra) Experiment Station [*R.A.M.*, xvii, p. 632].

Mushin (Rose). **Studies in the physiology of plant pathogenic bacteria. The food requirements of a xylem invader, Bacterium solanacearum E.F.S., and of a phloem invader, Aplanobacter michiganense E.F.S.**—*Aust. J. exp. Biol. med. Sci.*, xvi, 4, pp. 323–329, 1938.

A tabulated account is given of studies on the nutritional requirements on synthetic media of *Bacterium solanacearum*, isolated from diseased potatoes and tomatoes in Victoria [*R.A.M.*, xvii, p. 302], and of *Aplanobacter michiganense*, obtained from a stock culture also originating on tomatoes in Victoria [ibid., xvi, p. 214]. *Bact. solanacearum* utilized asparagin, peptone, tyrosine, and glutamic acid as sources both of carbon and nitrogen, while the former was also supplied by glucose, sucrose, glycerol, and sodium citrate and the latter by ammonia and potassium nitrate. Of all the experimental compounds furnished, only peptone was assimilated by *A. michiganense*.

Considerable variations in the morphology of *Bact. solanacearum* were observed. Fresh isolations from host plants consisted of Gram-negative coccobacilli, 0·4 to 0·8 by 0·3 μ, often occurring in pairs. On transference to another agar plate the rods elongated (1 by 0·5 μ), thickened, acquired rounded ends, and frequently appeared in pairs as large rods with a median constriction. On transference to broth the coccobacillus type developed once more. Long, slender filaments, composed of 10 to 20 cells, 1·2 by 0·5 μ, were frequently formed by the organism on subculturing from liquid media on to agar slopes. *A. michiganense* occurred in the form of single, Gram-positive rods, 1 by 0·4 μ.

Unlike Smith's strain, the Victorian isolation of *Bact. solanacearum* produced acid in glucose and a small quantity after several weeks in galactose. The strain of *A. michiganense* used in the tests formed small amounts of acid from glucose, saccharose, and salicin after a lengthy incubation period. Four months after isolation the culture of *Bact. solanacearum* was successfully reinoculated into two tomato plants, the exceptionally long retention of pathogenicity by the organism

being attributed to the rapid subculturing practised during the experiments.

Visocchi (V.). **La ticchiolatura del Pomodoro.** [Tomato leaf mould.]—*Ital. agric.*, lxxv, 10, pp. 648–689, 1938.

Tomato leaf mould (*Cladosporium fulvum*) attracted no particular attention in Italy until recent years, when reports of serious losses from this source were received from various localities. In this connexion a summary is given of some outstanding contributions by investigators in other countries.

Kienholz (R.) & Bidwell (C. B.). **A survey of diseases and defects in Connecticut forests.**—*Bull. Conn. agric. Exp. Sta.*, 412, pp. 493–559, 1 fig., 18 graphs, 2 maps, 1938.

A field survey of diseases and defects in Connecticut forests carried out from 1934 to 1936 showed that cankers caused by *Nectria coccinea* [*R.A.M.*, xvi, p. 645] and other *N.* spp. [ibid., xvii, p. 419], were the most prevalent form of defect. These cankers were found on 5·8 per cent. of all the trees (over 98,000 trees examined). Of the different species examined, birches, maples, and oaks showed, respectively, 12·5, 6·1, and 3·6 per cent. infection. So-called 'weed' species, such as mountain maple (*Acer spicatum*), were frequently infected; these may serve as a source of infection for more valuable trees, and should, if possible, be removed. In oaks, maples, and birches, 97, 86, and 51 per cent. of the cankers were situated on the main trunk within 8 ft. of the ground. Only 4·8 per cent. of the affected trees bore cankers on the branches. The average number of cankers per tree, all species, amounted to 2·9. Of the cankers found, 84 per cent. were not fruiting, 5 per cent. were fruiting sparsely, and 11 per cent. were fruiting abundantly. Many of the cankers appeared to have arisen through entry of the fungus into old branch stubs, others being associated with borer injury, frost cracks, rubs, and mechanical injuries. The evidence indicated that in birches particularly *Nectria* canker may cause death; oaks appeared to succumb if infected when young, but maples seemed to be able to outgrow infection. To the list of infected genera given by Welch [ibid., xiii, p. 732] the present study adds *Cornus*, *Alnus*, *Hamamelis*, *Salix*, and *Platanus*.

Cankers due to *Strumella corynoidea* [ibid., xvii, p. 83] were found on 0·2 per cent. of the total stand, and 0·6 per cent. of all the oaks examined, 69 per cent. of the cankers being within 8 ft. of the ground.

Of the living trees examined, 3·1 per cent. showed decay, the most common fruiting decay being due to *Fomes connatus* [ibid., xvii, p. 213], which was responsible for about three-fourths of all the named decays. Red maple (*Acer rubrum*) was most frequently infected. The second most prevalent fungus was *F. nigricans* [*F. fomentarius*: ibid., xviii, p. 214], which accounted for 13 per cent. of the named decays. Other fungi found were *Daedalea quercina*, *Armillaria mellea*, *Polyporus hispidus* [ibid., xviii, p. 69], *F. igniarius* [ibid., xviii, p. 214], *F. applanatus* [*Ganoderma applanatum*], *F. fomentarius*, and *F. fraxinophilus* [ibid., xviii, p. 69]. Cull due to visible decay was 4 and 0·6 per cent., respectively, of the small and large tree populations.

STRONG (F. C.). **Prevalence of wilt diseases in Maple and Elm.**—*Quart. Bull. Mich. agric. Exp. Sta.*, xxi, 2, pp. 96–99, 1938.

In the United States wilt symptoms are produced on elms by *Ceratostomella ulmi*, *Verticillium* sp. [cf. *V. rhizophagum*: *R.A.M.*, xvi, p. 142], *Dothiorella ulmicola* (formerly known as *Cephalosporium* sp.) [? *D. ulmi*: ibid., xvi, p. 782], and species of *Sphaeropsis*, *Coniothyrium*, and *Vermicularia*. The only parasitic fungus known to cause maple wilt is an unidentified species of *Verticillium* [ibid., xv, p. 693] which also infects elm, Japanese barberry [*Berberis japonica*], and other ornamental shrubs.

A careful laboratory study of 51 cases of dying American elms from different parts of Michigan revealed that 31 per cent. of the trees were affected by *Verticillium* wilt, 5 per cent. with *D. ulmi*, 2 per cent. with *Coniothyrium*, and 2 per cent. with *Sphaeropsis* canker, while in 41 per cent. no fungus was present and the wilting was attributed to non-parasitic agency. So far, *Ceratostomella ulmi* has not been detected in Michigan. Of 53 cases of maple wilt examined, 20 were due to *Verticillium* and the remainder to non-parasitic causes. Of the fungal infections, 90 per cent. were on Norway maple [*Acer platanoides*] and only 10 per cent. on hard maples. The paper terminates with brief notes on control.

RAY (W. W.). **Overwintering of Taphrina robinsoniana.**—*Phytopathology*, xxviii, 12, pp. 919–922, 1 fig., 1938.

Histological studies in 1936 of the bracts of dormant female alder (*Alnus incana*) catkins in New York State failed to disclose the presence of perennial mycelium of *Taphrina robinsoniana*, additional evidence in favour of the absence of which was afforded in 1937 by the reduction of infection on six young trees from between 90 and 100 to 19 per cent. as a result of two applications of 1 in 40 lime-sulphur. The conclusion that the mycelium plays no part in the perpetuation of the fungus was still further strengthened by experiments in which female catkin clusters, enclosed in transparent, waterproof bags, reached maturity without contracting infection. Spores of *T. robinsoniana* on potato dextrose agar plates remained viable from July to the following January at 27° C. and till March at 24°, indicating the probability of survival of these organs in nature from September until the period of spring infection under normal conditions.

LIERNUR (A. G. M.). **Heksenbezemvorming op Linde.** [Witches' broom formation on Lime.]—*Tijdschr. PlZiekt.*, xliv, 6, pp. 307–308, 2 figs., 1938.

In 1937 the writer inspected a lime [*Tilia*] tree in a Breda (Holland) nursery, the crown of which consisted of a multiplicity of short branches arising from adventitious buds. The case is presumably to be classed in the category of witches' brooms of non-parasitic origin [cf. *R.A.M.*, vi, p. 706].

DE HAAN (I.). **De Ceratophorum-bladziekte van jonge Albizzia planten.** [The *Ceratophorum* leaf disease of young *Albizzia* plants.]—*Arch. Theecult. Ned.-Ind.*, xii, 4, pp. 303–309, 6 figs., 1938. [English summary.]

Particulars are given of a leaf disease of *Albizzia falcata* and *A. sumatrana*

seedlings in West Java nurseries caused by *Ceratophorum albizziae*, which produces on the leaves circular, yellowish-brown spots, 1 to 1·5 mm. in diameter, surrounded by a dark green margin. The fungus was isolated from the diseased tissues and grown on various culture media, of which sterilized leaves of the host proved to be the most suitable for the development of the characteristic conidia (50 by 12 μ); on plum agar these organs are replaced by dirty brown chlamydospores. Inoculation experiments with fragments of the *Albizzia* leaf cultures on healthy seedlings in a humid atmosphere gave positive results.

Infection by *C. albizziae* was observed to be most prevalent in the Buitenzorg district following nights with heavy dew but without rain at the end of May and early June. In order to outgrow the attacks of the fungus the plants must have reached a height of over 30 cm., and the time of sowing in November should therefore be calculated accordingly. Another measure tending to reduce the incidence of the disease is the interplanting of the *Albizzia* seedlings with the immune lamtoro [*Leucaena glauca*]. A severe epidemic of the leaf blight over an extensive area was successfully combated by repeated applications at 7- to 10-day intervals from the beginning of June till the middle of October of Bordeaux mixture [concentration not stated] or nosperit plus 0·5 per cent. glue.

WHARTON (W. P.). **Are the Elms being saved?**—*Amer. Forests*, xliv, 12, pp. 545–547, 2 figs., 1 map, 1938.

The writer, as chairman of a national conference on Dutch elm disease [*Ceratostomella ulmi*] eradication, is of opinion that the present methods employed by the United States Government in dealing with the urgent work of control [*R.A.M.*, xviii, p. 70] are totally inadequate, and he is supported in these views by J. H. Faull and J. C. Boyce, a summary of whose recent joint field study of the campaign is quoted. Among other things, the indiscriminate recruitment, under the unemployment relief scheme of the Works Progress Administration, of untrained men for the highly skilled work of disease detection is regarded as a mistaken policy.

DAY (W. R.). **Root-rot of Sweet Chestnut and Beech caused by species of Phytophthora. I. Cause and symptoms of disease: its relation to soil conditions.**—*Forestry*, xii, 2, pp. 101–116, 1938.

Root rot (ink disease) of sweet chestnut (*Castanea sativa*), first observed in the New Forest in 1931 [*R.A.M.*, xv, p. 325], has been found to be due to *Phytophthora cambivora* [ibid., xviii, p. 70]. This fungus was also present quite commonly on beech. Furthermore, *P. cinnamomi* has been isolated from affected roots of sweet chestnut and *P. syringae* from root-rotted beech. The fungi attack the root, usually near the collar, spreading along the roots and a short distance up the trunk, and living mainly in the cambium and the inner cortex. According to field evidence the parasites do not depend upon wounds for successful infection, but in inoculation experiments the removal of the cork layer proved essential for positive results. On sweet chestnut the infection may spread very rapidly, the trees becoming girdled at the collar, the leaves, especially those on the top of the tree, wilting, and even very large trees dying within the first year of the disease. Chestnut trees

affected by the slower forms of the disease either produce very dwarfed leaves and flowers in the next year and then die, or (and this applies also to beech trees) show early yellowing and subsequent browning but not appreciable dwarfing of the leaves, and exude a fluid from dead or dying bark at the base of the trunk, this latter symptom being, however, quite commonly absent. Such trees either die after several years or may recover. Blue-black staining of the bark has been observed only with chestnut, and the name *Phytophthora* root rot is therefore proposed as a better general term than 'ink disease'. It was found almost impossible to isolate the fungi from dead or dark discoloured bark, but from lighter brown bark not yet killed by the parasites they were isolated with ease. Beech trees were often observed to die-back on shallow chalk soil, frequently showing symptoms similar to *Phytophthora* root rot, but no *Phytophthora* was isolated from such trees; and the chlorotic foliage frequently associated with this condition, but not observed in *Phytophthora* root rot, seems to point to a deficiency disease.

An examination of several soil profiles in diseased and healthy woods in England showed that severe attacks of the disease always occur on shallow, heavy, or compact soils with impeded drainage in the subsoil. It is suggested that the conditions which accompany impeded drainage may possibly predispose the host to attack by inducing in it a state of debility. In discussing the control of the disease, the author suggests that susceptible species should be planted only on dry and well-drained soils. Field observations confirmed the conclusion that chestnut coppice should be kept to the more fertile and sufficiently dry soils, as continued and frequent cropping of acid and moderately fertile soils with a tendency to compactness and poor drainage may result in a serious depletion of fertility and in increased impedance of drainage.

Beech is stated to be less susceptible to infection than sweet chestnut, remaining unaffected in areas where many sweet chestnuts have died. No epidemic outbreaks of infection have yet been known to occur on beech.

JONES (W. NEILSON). **On the occurrence of needle fusion in Pines in the south of England.**—*Emp. For. J.*, xvii, 2, pp. 244–246, 1938.

So far as is known at present, the only station where needle fusion of pine trees [*R.A.M.*, xvii, p. 444] has been observed in a typical form in Great Britain is on a small area of the Forestry Commission plantations near Wareham, Dorset. The soil in this locality is poor, sandy, gravelly, of very low mineral content, and very infertile. The affected species are *Pinus radiata* and *P. contorta*, and the symptoms are similar to but more marked than those noted in Australia. In some stands, 90 per cent. of the trees are probably affected; no recovery has occurred in the field, and in many instances death has ensued. Affected trees developed symptoms with great suddenness, whereas others in close proximity sometimes remained apparently healthy. Mycorrhiza were present in the affected trees but none appeared to be developed in the current season. Experimental evidence demonstrated that progressive recovery followed re-potting in good humus soil. Spectral analysis showed that the leaves of affected trees has a consistently lower boron content than the leaves of healthy trees but, so far, applications of boron or zinc have not given conclusive results.

Hepting (G. H.) & Chapman (A. D.). **Losses from heart rot in two Shortleaf and Loblolly Pine stands.**—*J. For.*, xxxvi, 12, 1193–1201, 1938.

A tabulated account is given of investigations on the etiology, extent, and economic importance of decay in a young stand of shortleaf and loblolly pines [*Pinus echinata* and *P. taeda*] in southern Arkansas and in an older stand of the former species only in eastern Texas. Most of the rot was found to be of the red-heart type, caused by *Fomes pini* [*R.A.M.*, xvii, p. 214] (40·4 out of a total of 51·1 per cent. in Arkansas loblolly, 19 out of 25·5 per cent. in Arkansas shortleaf, and 30·9 out of 37·3 per cent. in Texas shortleaf); the corresponding figures for butt rots due to *Polyporus schweinitzii* [ibid., xviii, p. 4], entering principally through fire wounds, were 1·2, 1·3, and 11·2 per cent., respectively. The cull percentages attributable to fungal rotting for Arkansas loblolly were 1·16 board ft. log scale, 0·12 cu. ft. log scale, and 1·20 on a lumber tally basis, the corresponding figures for Arkansas and Texas shortleaf being 0·23, 0·06, and 0·30 and 2·43, 1·33, and 1·77, respectively. The volume loss from rot in the infected Arkansas logs was 3·9 per cent., lumber tally basis, representing a financial loss of 7·9 per cent., the corresponding figures for Texas being 7 and 11·3 per cent., respectively.

Garren (K. M.). **Studies on Polyporus abietinus. II. The utilization of cellulose and lignin by the fungus.**—*Phytopathology*, xxviii, 12, pp. 875–878, 1938.

In further studies on *Polyporus* [*Polystictus*] *abietinus* [*R.A.M.*, xviii, p. 219] the capacity of the fungus for the utilization of cellulose and lignin in culture was tested, 2·5 per cent. of each constituent being added to a stock mineral agar medium. Cellulose proved to be superior to lignin as a source of nutrient, though the latter was also assimilated in sufficient quantities to permit of sparse growth, especially in the presence of 1 per cent. ammonium nitrate. When 0·5 per cent. tannic acid was incorporated in the medium, *P. abietinus* made good growth and developed a brown halo, indicating the formation of laccase, which probably catalyses the oxidation of the phenolic groups in lignin and so causes its partial decomposition. The production of a brown halo on a tannic acid medium in the Bavendamm test [ibid., vii, p. 68] need not be interpreted as showing that the fungus utilizes lignin alone, as the author's experiments show that both cellulose and lignin can be utilized by *P. abietinus*.

Toole (E. R.). **Relative durability of Black Locust and Shipmast Locust when subjected to four wood decay fungi.**—*J. For.*, xxxvi, 11, pp. 1120–1122, 1938.

The wood of shipmast locust [*Robinia pseud-acacia* var. *rectissima*] has long been regarded as more durable in service than that of the common black locust [*R. pseud-acacia*], and the results of recent laboratory tests have been interpreted as supporting this observation [*R.A.M.*, xvii, p. 635]. The data in question have been subjected by the author at the Duke School of Forestry [North Carolina] to an analysis of variance, and found to be significant only for two of the four fungi used in

the tests, *Poria incrassata* [see next abstract] and *Fomes rimosus*, differences between the two varieties in their reaction to *Polyporus robiniophilus* and *F. igniarius* having no practical importance.

HUBERT (E. E.). **The preservative treatment of millwork.**—*Industr. Engng Chem.*, xxx, 11, pp. 1241–1250, 4 figs., 1938.

One of the projects conducted in the Research Laboratory of the Western Pine Association in 1935 was a study of the possibilities of control of stain and decay in finished wood products, such as sashes, doors, frames, porch columns, and other types of millwork [*R.A.M.*, xvii, p. 782] liable to protracted exposure to moisture. It was obvious from the outset that this problem presented several new angles, and a full account is here given of laboratory experiments on the evaluation of toxicity, volatility, and leaching out in 25 chemicals and 18 proprietary wood preservatives, all of which were tested over a 60-day period on thin cross-sections of sapwood pine (*Pinus ponderosa*) to ensure rapid fungal development. Toxicity to *Lenzites trabea* [ibid. xvii, p. 783; xviii, p. 221], the principal agent of sash and door decay (over 70 per cent.), was determined both in the wood and in agar cultures, volatility by the watch-glass and Kolle flask methods, and leaching out by Arnold and Boller's practice of alternate drying and wetting [ibid., xvi, p. 79].

Besides *L. trabea*, the sapwood samples (mostly of *P. ponderosa*, but also including Idaho white pine [*P. monticola*], sugar pine [*P. lambertiana*], Douglas fir [*Pseudotsuga taxifolia*], redwood [*Sequoia sempervirens*], and western red cedar [*Thuja plicata*]), yielded *L. sepiaria*, *Trametes serialis* [ibid., xviii, p. 76], *Poria vaillantii* [ibid., xviii, p. 221], and *P. incrassata* [ibid., xvii, p. 786]. *L. trabea* is stated to have been recently isolated from a decayed sash sent from Bermuda, and to be capable of developing in wood at temperatures up to or exceeding 40° C., besides resisting treatment by a number of the better-known preservatives. Among the blue-staining organisms found in the sapwood or on the paint coatings of sashes and doors were *Pullularia pullulans* [ibid., xviii, p. 217], *Cladosporium herbarum*, *Hormiscium gelatinosum*, and *Discula pinicola* [ibid., xvi, p. 574], all of which likewise proved refractory to control by standard methods.

The three chemicals selected from nine of the most promising tested as particularly suitable for commercial use, namely, pentachlorophenol, tetrachlorophenol, and 2-chloro-*o*-phenyl-phenol, have been grouped under the name permatol D [cf. ibid., xvi, p. 148]; the average ratings of these compounds (based on toxicity, volatility, and permanence tests and cost) were 96·3, 87, and 82·1 per cent., respectively. Of the proprietary preparations tested, C 8, C 18, C 11, and C 16 were the most satisfactory, with ratings of 85, 86·8, 82·8, and 90 per cent., respectively. Amsco special solvent (Ohio Mineral Spirits Co.) and eocene were selected for use in these tests as a penetrant and spreader, respectively, from a number of other acceptable petroleum products investigated.

The requisite properties of wood species suitable for millwork and specifications for the effective treatment of the same are set forth in detail.

Van Wyk (J. H.) & Verwoerd (L.). **The toxicity of South African creosote.**—*J. S. Afr. For. Ass.*, *1938*, 1, pp. 47–50, 1938.

The toxicity of the creosote produced at the Iscor Works, Pretoria, was determined by a gravimetric method, in which the weight of creosote present in 1 cu.m. of wood that will restrict the loss of weight occasioned by fungus infection to 5 per cent. or less is adopted as a practicable criterion of toxicity. The losses in weight corresponding to progressively intensive impregnation were recorded and the toxic limits were considered as being bracketed within the pair of consecutive absorptions between which a 5 per cent. loss of weight occurs. The impregnation of the test blocks of *Pinus patula* from the Northern Transvaal was carried out in a glass cylinder under vacuum at 19° C., and the treated blocks then exposed in flasks to cultures of *Coniophora cerebella* [*C. puteana*] for a period of 13 weeks at a constant temperature of 25°. The results for three series of blocks showed the toxic limit of the Iscor creosote (toxicity kg./cu.m.) to be 2·95–5·29, 1·13–2·92, and 1·19–2·83, respectively, thus having a somewhat higher toxic value than the German and American creosotes, which are assessed by various investigators with toxic limits between from 2·3–3·4 to 5·4–9·2 and 6·1–9·7 to 9·0–11·3, respectively.

Tompkins (C. M.). **Charcoal rot of Sugar Beet.**—*Hilgardia*, xii, 1, pp. 75–81, 4 figs., 1938.

Charcoal rot of sugar beet caused by *Macrophomina phaseoli* [*R.A.M.*, xiv, p. 670] is reported to have been found in 1932 in the hot interior valleys of California, the incidence of infection ranging from 8 to 30 per cent. The fungus attacked half-grown and mature beets during the hot season and caused a wilting and eventual dying-off of the foliage, the dead leaves remaining firmly attached to the crowns. Externally the infection is usually confined to the crown region, where brownish-black lesions of irregular shape and size and with a silvery sheen are formed. On old lesions the periderm is very thin, papery, and loosely attached to the underlying tissues, cracking under slight pressure and exposing dry, black, carbonaceous masses of sclerotia. In cross section the advancing margin of a lesion is mustard-yellow but later turns a buffy citrine. Once the entire root is invaded the tissues become old gold in colour and finally brownish-black. In the late stages of decay, masses of black sclerotia largely displace the periderm and parenchymatous tissues, eventually occupying the pith so that only the vascular elements retain their identity. Completely invaded beets shrink and tend to become mummified.

Infection of sugar beet roots and seedlings was obtained in the laboratory with different isolates of the fungus from sugar beet and with isolates from bean, *Begonia tuberhybrida*, cotton, strawberry, and sweet potato. The optimum temperature for growth of one of the isolates from sugar beet was shown to be approximately 31° C. The diameter of the sclerotia ranged from 46·2 to 146·3 μ (mean 73·8 to 87·2 μ) and the fungus thus belongs to Haigh's C group (*M. phaseoli*) [ibid., ix, p. 685] though no isolate from sugar beet has yet produced pycnidia.

Claus (E.). **Die Zuckerrübenzüchtung von heute.** [Sugar Beet breeding to-day.]—*Zbl. Zuckerindustr.*, xlvi, 41, pp. 905–909, 1938.

Among the foremost problems of modern sugar beet breeding is the development of disease-resistant varieties, and a brief account is given of work in progress in this direction at Quedlinburg, Germany. Resistance to curly top [*R.A.M.*, xviii, p. 150] in American selections is stated to be combined with a strong tendency to 'bolting' and a relatively low sugar content. In a recent test the sugar content of the Gebr. Dippe selection Z amounted to 22·12 per cent. as compared with 19·22 per cent. in the American strain, the corresponding figures for 'bolting' being 0·6 and 5·7 per cent., respectively. Curly top is of interest to German growers on account of its similarity to crinkle [ibid., xvii, p. 642], the incidence of which has been experimentally reduced by 20 to 30 per cent. As regards leaf spot (*Cercospora*) [*beticola*: ibid., xviii, p. 6], observations in Spain have demonstrated a correlation between resistance and a non-leafy growth habit coupled with a high sugar content.

Decoux (L.) & Roland (G.). **Atlas des ennemis et maladies de la Betterave.** [An atlas of the pests and diseases of the Beetroot.]—56 pp., 20 col. pl., Brussels, A. & G. Bulens Frères, 1938. 30 Belgian fr.

This useful little book, intended as a practical guide for growers, contains brief notes in popular terms on the symptoms, causes, and control of the principal fungal, bacterial, physiological, and virus diseases, and insect pests of sugar beets found in Belgium. The work is illustrated by a number of excellent coloured plates, giving the popular names of the diseases in French, Flemish, German, and English as well as the causal organism (where present) in Latin. It is stated that during 1936 the loss sustained from virus yellows [*R.A.M.*, xviii, p. 79] in the provinces of Hainaut and Flanders, over an area of 18,000 hect., is estimated at 25,000,000 fr. [nearly £4 per acre].

Osborn (H. T.). **Studies on Pea virus 1.**—*Phytopathology*, xxviii, 12, pp. 923–934, 1 fig., 1938.

Pea virus 1 [*R.A.M.*, xviii, p. 150], difficult to transmit by the ordinary rubbing method, is communicable from diseased to healthy plants by the carborundum powder technique. However, sub-inoculation from mechanically infected plants to broad beans, both by means of aphids (*Macrosiphum pisi* and *M. solanifolii*) and rubbing, was found to produce much less satisfactory results than from insect-infected plants: in the former case failure generally ensued when the transfers were made less than 24 days after the original inoculation, while in the latter a three-day period sufficed for the multiplication of the infective principle. The virus was carried through four serial passages by mechanical inoculation in broad beans, at the close of which sub-inoculation was even more difficult than at first.

Pea virus 1 resisted ten minutes' heating *in vitro* at various temperatures from 52° to 64°, but succumbed at 66° C. It was destroyed by five but not by four days' ageing *in vitro* and by dilution to 10^{-4} but

not 10^{-3}. The virus was retained by aphids for periods up to eight days when they were transferred from diseased to a succession of healthy plants at 35°.

In addition to the original New York strain of the virus used in these experiments, a similar one from New Jersey was tested and found to differ slightly from the first both in symptomatology and ease of mechanical inoculation. On broad bean the initial signs of infection by the New Jersey strain consist of crinkling, distortion, and necrotic lesions on the leaves; later the large, yellow spots may be difficult to distinguish from those due to the New York strain. On crimson clover (*Trifolium incarnatum*) the New Jersey strain may be differentiated from the New York form by its tendency to cause necrotic spotting of the foliage. In mechanical inoculation tests on broad bean only nine out of 50 plants infected by the New Jersey strain developed the symptoms of pea virus 1 compared with 36 when New York inoculum was used.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, xlix, 11, pp. 608–612, 4 figs., 1938.

Bean [*Phaseolus vulgaris*] mosaic [*R.A.M.*, xvii, pp. 585, 716] is one of the most prevalent diseases of this crop in New South Wales, where it frequently causes heavy loss. Infection is carried over from season to season and spread from one locality to another by diseased seed. The condition is generally most prevalent in late spring and early summer, and its seriousness is strongly influenced by date of planting. None of the locally cultivated varieties of dwarf French beans displays any marked resistance [ibid., xvii, pp. 369, 646], but the pale varieties, Epicure and Kentucky Wonder, are moderately resistant. Until resistant varieties of good quality are available, control depends upon the use of clean seed. Crops should be planted as late as possible.

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xii, 12, pp. 269 M–270 M, 1938.

ALGERIA. Citrus- and cotton-growers of Algeria are required by Decrees of the President of the French Republic, dated 17th June, 1938, to join local associations (grouped into a compulsory union) for the organization and improvement of disease control. In the case of cotton, cultivation is permitted only within certain recognized areas, the limits of which are defined or modified by Decree of the Governor-General of Algeria.

Government Notice No. 11. The Plant Protection Decree, 1937. The Plant Protection (Importation of Pineapples) Order, 1938.—*Off. Gaz. Zanzibar Govt. Legal Suppl.* (Part II), xlvii, 2470, 1 p., 1938. [Mimeographed.]

By the Plant Protection (Importation of Pineapples) Order, 1938, the importation into Zanzibar of pineapple plants, fruits, or parts is prohibited except under written permit issued by the Director of Agriculture.

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BERGER (G.). **Un nouveau parasite du Pois observé en Chaouïa (Maroc).** [A new parasite of Pea observed in Chaouïa (Morocco).]—*Rev. Path. vég.*, xxv, 4, pp. 239–243, 1 pl., 1938.

Peas growing in Chaouïa, French Morocco, are infected by a disease producing yellowish, diffuse spots on the stems, yellow to greyish, angular spots on both surfaces of the leaves, and occasionally yellowish, diffuse spots on the sides of the pods or along the whole length of the dorsal suture. The spots on the leaves are limited by the main veins or by a thin, brown margin; the affected leaves wither and dry up, while the petioles and tendrils, when attacked, turn uniformly yellow and shrivel. The affected areas are covered with the dark yellow to blackish fruiting bodies of the causal fungus. As a rule, infection starts in the basal parts and spreads progressively upwards, though occasionally isolated lesions occur on the leaves and stems. The fungus rarely progresses beyond the first pods, and no lesions are found on the very young parts of the plants. The disease is never fatal, but causes appreciable damage to young plants, which produce only a few small pods. Infection begins in November, in the new plantings, grows worse during the winter, and becomes general during flowering, in February and March. The disease is much more prevalent in humid than in dry localities.

The causal fungus is named *Cylindrosporium pisi* n.sp. [with a Latin diagnosis]. It is characterized by round or elliptical, depressed, light brown acervuli, 300 to 500 μ in diameter, with a brown or black margin, hyaline, continuous conidiophores, tapering at the apex, and measuring 8 to 14 by 3 to 4 μ, and hyaline, cylindrical, straight or slightly curved 1- to 2-, occasionally 3-septate conidia, rounded at the apex, and measuring 28 to 48 by 3 to 3·5 μ.

SMITH (F. L.) & HEWITT (W. B.). **Varietal susceptibility to common Bean mosaic and transmission through seed.**—*Bull. Calif. agric. Exp. Sta.* 621, 18 pp., 4 pl., 1938.

Seedlings of 118 bean [*Phaseolus vulgaris*] selections representing 51 varieties were inoculated in field plots by the carborundum leaf abrasion method with the mosaic virus [*R.A.M.*, xviii, p. 288 and next abstract] and the seed harvested therefrom planted at Berkeley and Davis, California. The percentage of seed transmitting mosaic for each selection is presented, the selections being arbitrarily classified in five categories according to the severity of the symptoms. To cite a few

examples, class 0 (plants with no symptoms) contained Great Northern (Idaho strains 1, 59, and 81) and Michigan Robust; representatives of class 1 (slight symptoms) included Bayo and Robusta; of class 2 (moderate symptoms) Kentucky Wonder, Red Kidney, Dark Red Kidney, and Cranberry; of class 3 (severe) Great Northern (three strains), Blue Pod, Mexican Red, two Stringless Green Pods (Burpee's and Refugee), and Large White; and of class 4 (very severe) Otenashi, Kotenashi, and Small White. The weighted averages of percentages of seedlings infected for all selections in the five classes were as follows: (0) Berkeley 0·0, Davis 1·7 per cent.; (1) 6·8 and 1·1, respectively; (2) 9·4 and 20·8; (3) 20·3 and 23·3; and (4) 36·1 and 30·4.

The correlation coefficients between mosaic category and percentage of seed-borne infection was $0{\cdot}640 \pm 0{\cdot}054$ and $0{\cdot}608 \pm 0{\cdot}058$ at Berkeley and Davis, respectively. These data are considered to indicate that the degree of severity of mosaic symptoms within the various classes, as here summarily defined, represents the relative susceptibility of the varieties tested and consequently may be used as a criterion of susceptibility to the disease. The generally more severe infection at Davis may be attributed to early aphid [*Macrosiphum pisi*] infestation. The mean daily temperatures at Berkeley during the growing season were from 61° to 62° F., the corresponding figures for Davis being 70° to 76°, but these differences were apparently not correlated with any divergence in the nature of the symptoms in the two localities.

From these results it is evident that in general varieties most severely affected with mosaic produce a higher percentage of infected seed than those less affected. Mosaic plants should be removed from the fields as soon as they can be recognized and growers saving their own seed should rogue as many times as necessary to eliminate infection before harvesting.

Moore (W. D.). **Field studies of certain diseases of Snap Beans in the Southeast.**—*Tech. Bull. U.S. Dep. Agric.* 647, 28 pp., 4 figs., 1938.

The development of bean [*Phaseolus vulgaris*] dry root rot (*Fusarium martii phaseoli*) [*F. solani* var. *martii*: *R.A.M.*, xvi, p. 727] was studied on the Stringless Black Valentine and the Bountiful varieties of beans for four years at Charleston, South Carolina, under varied cultural practices. The infection was heavier on beans planted 2 in. deep than on those planted at 1 or ½ in., and tended to develop more in crops planted very early in the spring than in those planted at later dates. The various fertilizers used did not consistently affect dry root rot infection. Throughout the study seasonal conditions appeared to exercise a greater influence upon infection than most of the treatments tested. In these studies the degree of dry root rot development appeared to have no significant effect on yield.

Significant differences, varying from one season to another, were found between the 26 varieties of snap beans tested for susceptibility to mosaic [see preceding abstract], Hodson Wax and Red Valentine being more susceptible than most of the others, and for susceptibility to dry root rot, which ranged from 5·9 per cent. infection in Asgrow Stringless Valentine and Longfellow to 26·3 per cent. in Wardwell Kidney Wax. The wide differences in the yields of the varieties tested,

which also fluctuated from one season to another, were apparently not due to the degree of resistance to these two diseases but to some other varietal characteristics and to regional adaptations. The yield per plant of spring and autumn crops of Refugee 1000 to 1 beans infected with mosaic was only 77 and 50 per cent., respectively, of that from healthy plants, the corresponding figures for Early Refugee being 79 and 50 per cent. Mosaic-infected plants produced a reduced number of marketable pods per plant, and those produced were significantly shorter and lighter in weight than those from healthy plants.

Damping-off of beans in the south-east is most commonly due to *Pythium de Baryanum*. It is particularly destructive in the early spring, but plants which emerge normally may show damping-off of the lateral roots which retards development to a marked degree. None of the seed treatments tested had a significant effect on yield, but stands were slightly improved by ethyl mercury tartrate treatment and depressed by semesan [ibid., xvii, p. 503] seed treatment.

Yu (T. F.). **A blossom blight of Broad Bean (Vicia faba L.) caused by Botrytis cinerea Pers. under glass.**—*Lingnan Sci. J.*, xvii, 4, pp. 551–566, 3 pl., 3 graphs, 1938. [Chinese summary.]

In December, 1934, broad beans (*Vicia faba*) growing in a greenhouse in Nanking developed blossom blight caused by *Botrytis cinerea* [cf. *R.A.M.*, xvi, p. 723]. Minute, light yellow to brown, water-soaked spots appeared on the flowers, rapidly enlarged, and turned dark brown. Lesions were abundantly present on the petals of open flowers, which started to wither and finally became black and brittle. The fungus differed in culture from the strain reported on the same host from Spain [ibid., xi, p. 347] in its abundant production of white, later slightly green, finally shiny black, circular, elliptical, or irregular sclerotia; these measured 1 to 6 mm. in diameter on different media and were flattened or depressed on the upper surface and concave on the lower. The disease seldom occurred in well-ventilated houses. One application of Bordeaux mixture (4–4–50) when the flower buds open is recommended as giving complete control.

Henrick (J. O.). **Late blight of Celery (Septoria apii-graveolentis Dorogin).**—*Tasm. J. Agric.*, N.S., ix, 4, pp. 211–213, 1 fig., 1938.

During the past season, several celery beds in the vicinity of Launceston, Tasmania, were severely affected by the small-spot type of leaf spot due to *Septoria apii-graveolentis* [*R.A.M.*, xvii, p. 722]. Control consists in improved sanitary measures and crop rotation, seed treatment by dipping in mercuric chloride 1 in 1,000 (1 oz. in $6\frac{1}{4}$ gals. water) for 15 minutes, steeping in formalin solution (1 in 400) for 3 hours, or by immersion in hot water (118° F.) for 30 minutes, followed by cold rinsing, and protection of the growing crop by spraying with Bordeaux mixture (6–4–40). The plants should be sprayed when about 1 in. high, again a day or two before transplanting, and when 6 in. high, two further applications being made at intervals of 10 to 12 days. In subsequent seasons, attention to cultural hygiene and the use of clean seed should suffice to keep the beds healthy.

Jahnel (H.). **Eine Spritzaktion zur Bekämpfung des Spargelrostes.** [A spraying campaign for the control of Asparagus rust.]—*Kranke Pflanze*, xv, 11, pp. 195–199, 1 graph, 1938.

Details are given of the organization and execution of a spraying campaign initiated in 1938 in the Lössnitz (near Dresden) district of Saxony against asparagus rust [*Puccinia asparagi*: *R.A.M.*, xvii, p. 581], which has been a source of such heavy losses to the local growers since 1931 as to necessitate special measures for its control. The application of 1 per cent. Bordeaux mixture at 8- to 10-day intervals commenced on 12th May and was continued until 25th June in eight localities covering a total area of 48·51 hect., using an average amount of mixture of 600 l. per hect. with a total consumption of 2,500 kg. at an inclusive cost of RM. 3,583.03. Apart from one or two exceptions, the treatment gave eminently satisfactory results and arrangements are to be made for its repetition in 1939.

Fron [G.] & Bonnemaison. **Sur une maladie à virus du Céleri et du Concombre.** [On a virus disease of Celery and Cucumber.]—*C.R. Acad. Agric. Fr.*, xxiv, 26, pp. 897–904, 1938.

The senior author contributes a prefatory note to his ex-student's investigations on a disease resembling cucumber and celery mosaic [*R.A.M.*, xviii, p. 83], the cause of heavy losses to growers in the Lyons district of France, necessitating the virtual abandonment of the former crop and rendering the latter more or less unsaleable. Early in June a faint chlorosis and retardation of growth become apparent in celery seedlings sown in the open at the beginning of May. The outer leaves spread out and turn pale, the middle ones remain erect but are definitely smaller than those of healthy plants, while the central foliage is abnormally short and displays a mosaic of small, dark green and vivid yellow patches. The affected plants continue to grow during August and September, by which time the entire plot is infected. The inoculation of cucumber seedlings by rubbing the leaves with juice from infected celery plants resulted in delayed growth as compared with the controls after eleven days and in the development of chlorosis and other foliar abnormalities in 90 per cent. of the plants, 10 per cent. of which further showed a definite mosaic pattern of dark green and pale yellow. *Aphis gossypii* appears to be implicated in the transmission of the disease from celery to cucumber.

Böning (K.). **Phyllosticta-Fleckenkrankheit der Sojabohne.** [The *Phyllosticta* spot disease of the Soy-Bean.]—*Prakt. Bl. Pflanzenb.*, xvi, 7–8, pp. 168–172, 4 figs., 1938.

In a field of soy-beans near Straubing, Bavaria, *Phyllosticta sojaecola* [*R.A.M.*, xi, p. 88] was observed causing a spotting of the leaves and often of the stems and fruits. On the leaves the spots were round or oval, 1 to 15 mm. in diameter, and dark to olive brown with a characteristic darker margin. The stems showed brown stripes about 20 mm. long. The spots on the pods were mostly round, brown with a reddish margin, and 1 to 5 mm. in diameter. Numerous brown, spherical pycnidia were embedded in the affected tissue, those on the leaves measuring 50 to 120 μ and those on the fruit up to 180 μ in diameter;

the spores averaged 5 to 6 by 3 μ. In pure culture the fungus developed a rapidly blackening, submerged mycelium and a dense, fluffy aerial mycelium bearing numerous microsclerotia. Sometimes larger sclerotia were also formed. The higher fruiting form of the fungus, *Pleosphaerulina sojaecola* [loc. cit.], was not observed. Infection is seed-borne, and seed disinfection together with the destruction of diseased plants and harvest debris are recommended for the control of the disease.

BOSE (R. D.). **The rotation of Tobacco for the prevention of wilt disease in Pigeon-Peas [Cajanus cajan (Linn.) Millsp.]**—*Agric. Live-Stk India*, viii, 6, pp. 653–668, 2 diags., 4 graphs, 1938.

Evidence had already been obtained in experiments at Pusa in 1933–4 that the incidence of pigeon pea (*Cajanus cajan*) wilt (*Fusarium vasinfectum*) [*R.A.M.*, xvii, p. 652] may be minimized by growing the crop in succession to tobacco, and further trials are stated to have fully substantiated the previous results.

In 1934–5 observations were initiated on a set of four lysimeters filled with alluvial soil from a tobacco field and another set containing similar soil from an adjacent linseed field, all of which were inoculated annually until 1936–7 with spore material of the fungus and sown with the highly susceptible Pusa pigeon pea Type 5, weekly counts of the mortality from wilt being made from the fourth week onwards. The disease was very severe in all the lysimeters, the mortality in the tobacco and linseed series being, respectively, 99·5 and 100 per cent. in 1934–5, 100 and 100 per cent. in 1935–6, and 91·5 and 98·5 in 1936–7, but the time taken by the plants to die was found to be significantly longer in the tobacco than in the linseed soil (5·67 as compared with 4·77 months in 1934–5, the corresponding figures for 1935–6 and 1936–7 being 3·25 and 2·79 and 3·93 and 3·37, respectively). The plants in the tobacco series were also more vigorous than those in the linseed soil, judged by the average diameter of the stems (1935) ($6{\cdot}67 \pm 0{\cdot}28$ as against $5{\cdot}7 \pm 0{\cdot}22$ mm.).

The results of the foregoing tests were strikingly confirmed by a field experiment in 1936–7, which showed that the growth of *F. vasinfectum* is retarded by rotation with tobacco, thus enabling the pigeon pea to escape infection to a considerable extent, particularly at an early age. The total percentage of wilted plants in the artificially infected tobacco plot was only 70·05 compared with 95·29 in infected fallow soil, the average time taken by plants to die being 6·71 and 5·74 months in the two plots, respectively, the corresponding figures for plots not artificially infected being 34·6, 78·08, 7·86, and 6·55. These differences are considered to be statistically significant. It is surmised that the adverse effect of the tobacco crop on the wilt fungus is due to the presence of stumps and buried roots in the soil.

For control purposes in addition to the use of wilt-resistant pigeon peas, Types 80 and 82, the writer advocates the interposition of a tobacco crop every three or four years, especially in districts where the disease is very severe, such as parts of North Bihar. In low-lying areas it may be sufficient to bury tobacco stems in the soil a month or more before sowing the pigeon pea crop.

Branas (J.). **Le court-noué en Afrique française du Nord.** [Court-noué in French North Africa.]—*Progr. agric. vitic.*, cx, 44, pp. 373–379, 1938.

The author considers that the recently established introduction of *Phylloxera* [*vastatrix* f. *radicicola*: *R.A.M.*, xvii, p. 793] into Algeria and Tunis is very likely to contribute to a more or less rapid spread in those colonies of court-noué of the vine [ibid., xviii, p. 86]. He again stresses the necessity of carefully eradicating all court-noué stocks, especially in *Phylloxera*-infested areas, after which the soil should be rested or grown to non-susceptible crops for some years. The chief precaution, however, when making new or reconstituting old vineyards, should be to ensure the complete freedom of all planting material from disease.

Stellwaag (F.) & Branas (J.). **Chronique. Des phénomènes de dégénérescence de la Vigne. Sur le 333 E.M. (Foëx.)** [Current notes. Some phenomena of Vine degeneresce. On 333 E.M. (Foëx).]—*Progr. agric. vitic.*, cx, 46, pp. 413–417, 1938.

In the part of this paper dealing with degeneration diseases of the vine in Germany, F. Stellwaag states that court-noué [see preceding abstract] or 'reisigkrankheit' is very prevalent in the region of the Ahr [*R.A.M.*, xiii, p. 213]. The diagnostic symptom is the presence of intracellular cordons. The author considers that much of the available information points to the disease being of virus origin. Leaf roll or 'rollerkrankheit' is a different kind of degeneration phenomenon, in which the leaves roll over towards the base, develop an autumn colouring prematurely, and show abnormal susceptibility to environmental factors. The fruit bunches are wanting in density, and the yield is unreliable. Transmission can occur through grafting and this disease also is regarded as of virus origin. Precocious senility or 'überaltern' is a growth phenomenon unassociated with any virus, although the symptoms include witches' broom formations, shortened internodes, and change of shape of the leaves. Intracellular cordons are absent. In eastern Germany, a trouble (referred to as 'kräutern') occurs which shows itself in the branching and over-abundance of the foliage. The internodes are shortened, but not in the same way as in court-noué. The leaves often fail to reach a normal size, though their shape is normal. The cells do not as a rule show the presence of intracellular cordons, and, so far as is known at present, the condition is not due to a virus. In most cases the trouble follows frost, or a lack of affinity in grafted vines, or some nutritional deficiency. 'Markkrankheit' or pith disease [*Pumilus medullae*: ibid., xvii, p. 793] is rare in Germany itself, but has been noted on Austrian vines and young grafted vines.

In the opinion of Branas, precocious senility ('überaltern') may possibly correspond to the slow form of apoplexy observed in damp localities [ibid., xvii, p. 372], while 'kräutern' is the form of court-noué due to frost; 'rollerkrankheit' would appear to resemble flavescence [= 'rougeau' of red vines: ibid., xii, p. 675], and may be a transmissible form of the condition. Branas further states that neither 333 E.M. nor any other varieties are known to be resistant to court-noué, since

in all cases (except, perhaps, *Vitis rotundifolia*) the roots are infested by *Phylloxera* [*vastatrix* f. *radicicola*: ibid., xvii, p. 653].

MARCHIONATTO (J. B.). **Contribución al conocimiento del 'Botrytis cinerea' en la Republica Argentina.** [A contribution to the knowledge of *Botrytis cinerea* in the Argentine Republic.]—*Jornadas agrón. vet., B. Aires, 1937*, pp. 179–195, 2 pl. (1 col.), 7 figs., 1938.

Botrytis cinerea occurs in the Argentine as a parasite on vines, carnations, oranges [*R.A.M.*, x, p. 24], strawberries, roses, and dahlias. The writer's studies have been mainly concerned with the effects of the fungus on White Muscatel grapes [ibid., xvii, pp. 293, 499, *et passim*] and Henri IV roses [ibid., xvii, pp. 248, 682], the symptoms of the disease on which, the mode of infection, the life-history of the causal organism, and measures for its control are concisely described.

WARE (W. M.) & GLASSCOCK (H. H.). **Department of Mycology.**—*J.S.-E. agric. Coll., Wye*, xliii, pp. 15–23, 1939.

In this report [cf. *R.A.M.*, xvii, p. 373] it is stated that dwarfed oats received at Wye showed the presence of *Dictyosporium opacum* [ibid., x, p. 446] on pale lesions with brown margins on the lowest internode. Tick beans [*Vicia faba*] affected by chocolate spot (*Botrytis cinerea*) [cf. ibid., xvii, pp. 646, 787] showed only very few discoloured areas on the stem, on which the attack took the unusual form of deep lesions or cankers, generally at a leaf scar, and present from ground-level to a height of 18 in. The lesions were $\frac{3}{4}$ to 3 in. in length and covered with the conidiophores of the fungus. Frequently the stem was broken and the crop appeared to be in a very sickly condition. There was some evidence of the presence of *Sclerotinia sclerotiorum*, possibly as the primary pathogen.

A brown stipple-spotting of the leaves of Eclipse potatoes was due to manganese deficiency [ibid., xvi, p. 269]. Potentate tomatoes near Hythe were seriously affected by mixed-virus streak [ibid., xvi, p. 842]. On the vegetative parts of the tomato plant single and mixed-virus streak cannot be distinguished without a test, but on the epidermis of the fruit the former produces sunken and the latter raised brown marks. A quince tree at Haywards Heath showed the presence of *Podosphaera leucotricha* on the upper and lower leaf surfaces; about one-half of the fruits were also reported to be affected.

In a 15-year-old hop garden (Tutsham variety) near Faversham twenty-seven hills in a group interspersed with some healthy ones showed symptoms somewhat resembling infectious sterility [ibid., xv, pp. 395, 605]; the bines and laterals were normal, but the cones were few and small, averaging $\frac{1}{2}$ in. in length. The foliage was in some cases darker than normal. Sudden death of the growing point of the main bine was not observed. Fluffy tip [ibid., xvi, p. 367] was not seen in 1938.

Pseudobalsamia microspora [ibid., xvii, p. 379] was found in a mushroom [*Psalliota* spp.] house near Maidstone and in London. *Geomyces auratus* and *Trichoderma viride* [ibid., xiv, p. 366] were found in mushroom compost.

Hungerford (C. W.). **Plant pathology.**—*Rep. Idaho agric. Exp. Sta., 1937* (*Bull.* 225), pp. 55–59, 1938.

In further work on the development of bean [*Phaseolus vulgaris*] varieties resistant to curly top and mosaic in Idaho [*R.A.M.*, xvi, p. 22; xviii, pp. 150, 290] many selections of Great Northern beans showed complete resistance to both diseases. The mosaic-resistant Great Northern beans U.I. 59, U.I. 81, and U.I. 123 now constitute locally almost the whole planting of commercial Great Northern beans. Eight growers who received seed of the new Norida bean in 1937 reported that it was earlier maturing than their own crops and completely free from bean mosaic.

Physiologic race 19 of cereal stripe [yellow] rust [*Puccinia glumarum*] predominates in Idaho.

The vacuum method of inoculating barley seed with chlamydospores of *Ustilago hordei* gave up to 82 per cent. infection [cf. ibid., xviii, p. 172], Tapke's method giving the next best results, with 70 per cent. infection [cf. ibid., xvi, p. 375]. Inter- and intraspecific monosporidial crosses between *U. hordei* and *U. nigra* [ibid., xviii, p. 308] showed that segregation for sex may occur in the first or second reduction division. Hybridization takes place readily, with the production of echinulate chlamydospores in the F_1 generation, in which smutted heads resembling both parents were obtained.

Paluch (J.). **Doświadczenia nad zjadliwością różnych szczepów Pseudomonas tumefaciens i Phytomonas rhizogenes dla Pelargonij oraz nad wpływem niektórych enzymów trawiących na nowotwóry otrzymane doświadzalnie.** [Experiments on the virulence of some strains of *Pseudomonas tumefaciens* and *Phytomonas rhizogenes* on Pelargonium, and on the influence of some digestive ferments on experimental crown gall.]—*Acta Soc. Bot. Polon.*, xv, 1, pp. 37–46, 1 pl. [following p. 60], 1938. [English summary.]

When strains of *Pseudomonas* [*Bacterium*] *tumefaciens* and *Phytomonas* [*Bact.*] *rhizogenes* were inoculated into wounded stems of very young *Pelargonium* plants some considerable distance above soil-level, positive results were obtained only with the 'Bela' strain of *Bact. tumefaciens*, obtained from the Lister Institute, London [cf. *R.A.M.*, xviii, p. 160].

In repetition of the experiments of P. A. Ark [ibid., xvi, p. 590] 11 galls on *Pelargonium* plants that had been inoculated with *Bact. tumefaciens* ('Bela' strain) were treated with papain and an equal number with pepsin, eight remaining untreated as controls. The enzymes were applied as a powder, placed in incisions where small sections of the galls had been cut away. Similar sections were cut from all the control tumours, and all the wounds were wrapped in cellophane. Six of the pepsin-treated galls deteriorated one month after treatment, while five showed only very slight injury or none at all. Of the papain-treated galls, three died, while the others remained partly or wholly intact. Of the controls, four died in the same way as the treated ones. These results indicate that papain and pepsin are not always effective in the treatment of crown gall, necrosis of which may be induced by mechanical injury.

Sprague (R.). **The status of Septoria graminum.**—*Mycologia*, xxx, 6, pp. 672–678, 5 figs., 1938.

From a review of the relevant literature and the critical examination of herbarium material, the author considers that the widespread concept of *Septoria graminum*, based on Saccardo's description, is an unjustifiable grouping of at least three distinct species, namely, *S. graminum* proper, *S. calamagrostidis*, and *S. tritici* [cf. *R.A.M.*, xiii, p. 434]. To judge from the type specimen of *S. graminum* on *Brachypodium sylvaticum* and from the apparently more mature material collected by Saccardo and Vestergren, this species occurs on *Brachypodium* spp. in Europe, and has medium-sized hyaline, aseptate to faintly uni- or sometimes bi-septate, very uniformly narrow, and somewhat curved pycnospores, 15 to 55 (but mostly 24 to 45) by 0·8 to 1·5 μ. Studies in progress in Oregon and Washington with a number of species of this genus on 20 genera of Gramineae, including 58 species of naturally infected grasses and cereals, indicate that *S. graminum* is not a plurivorous species. *S. calamagrostidis* occurs on *Agrostis palustris* in Oregon whilst the filiform species on wheat is *S. tritici*. The diagnostic characters of species of *Septoria* parasitizing Gramineae are summarized in an appended table, and a revised English description of *S. graminum* is also given.

Soukhov [Soukhoff] (K. S.) & Vovk (A. M.). **Mosaic of cultivated cereals and how it is communicated in nature.**—*C. R. Acad. Sci. U.R.S.S.*, N.S., xx, 9, pp. 745–748, 2 figs., 1938.

Further experiments on the mosaic disease of oats substantiated the earlier evidence as to the virus nature of this disease [*R.A.M.*, xvii, p. 668]. When oats were grown under gauze to protect them from insects no signs of disease appeared on the plants, but when small holes were made in the gauze to allow the tips of seedlings to pass through, 8·5 per cent. of the cages were found to contain diseased plants, proving that insects were responsible for transmitting the disease. In transmission experiments with various insects positive results (67·1 per cent.) were obtained with *Delphax striatella* (sexually mature males and females and larvae) after an incubation period of 7 to 9 days. By means of this insect the disease was successfully transmitted from oats to barley and millet [*Panicum miliaceum*] and from barley to oats. Mosaic was further detected in rye and maize, and wheat is also apparently liable to infection, as well as *Calamagrostis epigeios*, although this plant seems to be generally very resistant to mosaic. In cytological studies the presence of aciculate crystals was detected in the cells of mosaic-diseased plants, and new forms of giant crystals in the shape of rings, eights, and twisted braids, were observed in the epidermal cells and guard cells of the stomata, whereas they were never found in the cells of healthy plants. In their dimensions and shape these giant crystals resemble the protein crystals of the Cactaceae and their protein nature is indicated by microchemical tests. They sometimes break up into small, aciculate crystals. Similar giant crystals have also been found in mosaic-infected millet, barley, and maize, and they are believed to be the virus itself.

EKSTRAND (H.). **Några ekonomiskt viktiga sjukdomar på höstsäd och vallväxter.** [Some economically important diseases of autumn-sown grain and grasses.]—*Medd. Växtskyddsanst., Stockh.*, 25, 23 pp., 6 figs., 1938. [German summary.]

The snow mould (*Fusarium minimum*) [*Calonectria graminicola*] is stated to be the chief agent of damage to autumn-sown cereals, especially rye, in Sweden [*R.A.M.*, xiv, p. 21], some 230 samples examined in 1938 from all parts of the country having been contaminated by the fungus, which was also prevalent on meadow grasses, turf, and natural greens. Infection probably takes place to a considerable extent through the soil.

Further information is presented concerning the relation of *Typhula itoana* (considered to be the correct name for *T. graminum*) [ibid., xvi, p. 802; xvii, p. 230; xviii, p. 34] to winter injury of cereals and grasses. In 1936 the yield of a wheat crop in Dalarna was reduced by 75 to 80 per cent. by the attack of the fungus, fallen birch leaves bearing the sclerotia of which were scattered in profusion through the field. Next year timothy [*Phleum pratense*] on the same site was slightly infected and birch leaves with sclerotia were again observed on the ground both in 1937 and 1938; in the latter year the bulk of the damage on timothy was caused by another species of *T.*, which was also responsible for severe injury to wheat and rye in the previous winter. In the spring of 1938 the sclerotia of *T. itoana* were detected in another locality on fallen birch leaves in an infected wheat field. In an experiment, beech leaves which had fallen into inoculated pots bore sclerotia of the fungus in the following spring. In cross-inoculation tests, in which sterilized and unsterilized fallen birch leaves, dried and living rye and wheat leaves, and *Stellaria media* leaves were infected by *T. itoana* from different sources, positive results were obtained in every case, showing that the organism is capable of persisting as a pure saprophyte in a given area even where crop rotation is practised.

Like *C. graminicola*, *T. itoana* flourishes under a heavy snow-cover at slightly above a temperature range of 0° to 5° C. In comparative varietal observations on rye at the Luleå branch of the Swedish Association it was noted that southern selections were most severely injured by fungi of the *T.* group, while those of northern origin suffered either predominantly from the snow mould or from both sources equally. In a rye experiment in 1938, a *T.* sp. with small, black sclerotia was much more prevalent than *T. itoana*; outstanding resistance was shown by two varieties, one of which remained entirely healthy, while the other bore only traces of *T. itoana* and was free from the other *T.* sp. and *C. graminicola*.

The hosts of *Sclerotinia borealis* in northern Sweden include timothy, rye grass [*Lolium perenne*: ibid., xvi, p. 802], rye, wheat, *Poa annua*, *P. pratensis*, *P. serotina*, *Agrostis vulgaris*, and *Festuca rubra*. Generally speaking, grasses of southern origin are more susceptible to infection than the indigenous northern strains. Nilsson and Naesman observed, for instance, in 1937 (*Svensk Utsädesfören. Tidskr.*, xlvii, p. 20) that Bothnia timothy at Luleå showed a high degree of resistance to the fungus.

Briefly discussing winter-hardiness in cereals and grasses, the writer

thinks that, under Swedish conditions, the condition is practically synonymous with resistance to parasitic infection. The heaviest losses, as indicated above, are liable to occur during relatively mild winters in which the unfrozen ground is covered with a thick layer of snow.

In 1936 fruit bodies of *Mitrula sclerotiorum* [ibid., xv, p. 725] were observed to emerge from the sclerotia of *S. trifoliorum* [ibid., xvii, pp. 252, 699, 825], the principal agent of winter injury to clover, and in 1937 the former fungus was again recorded from various localities. In the writer's opinion, *M. sclerotiorum* is not a parasite of clover but of *S. trifoliorum*. *T. trifolii* [ibid., xv, p. 388] was also detected in 1937 on dead clover plants from about 15 localities. Both *S. trifoliorum* and *T. trifolii* have been found in clover seed, being capable of attacking the upper parts of the plants in hot weather. *S. trifoliorum* is pathogenic to first-year clover as well as to older crops, and also occurs on blue lupins [*Lupinus angustifolius*] and black or hop medick [*Medicago lupulina*].

HUMPHREY (H. B.), JOHNSTON (C. O.), CALDWELL (R. M.), & COMPTON (L. E.). **Revised register of physiologic races of leaf rust of Wheat (Puccinia triticina).**—18 pp., U.S. Dep. Agric. Bur. Pl. Ind., Div. Cereal Crops and Dis., 1939. [Mimeographed.]

This is a revision of the list of physiologic races of wheat leaf rust (*Puccinia triticina*) published by the first three authors in 1936 [*R.A.M.*, xvi, p. 732], bringing the number of recognized races up to 108. An analytical key is given to assist in the identification of the different races. No attempt has been made in the list to eliminate anything except obvious duplications. The three physiologic races isolated by Hassebrauk in Germany and designated A, B, and C [ibid., xvii, p. 226] are numbered 92, 93, and 94, respectively. Of the six new races numbered 64 to 69 by Mme Rashevskaya and Barmenkoff [ibid., xvi, p. 163], the first appears to be a mixture of race 77 and some other race, and is omitted, while race 65 is identical with 31, and 66 with 77. The Russian workers' races 67 and 68 appear to be valid, and are retained under the numbers 98 and 99, respectively. Their race 69 is, however, doubtful, and probably cannot be separated from 99; it is, therefore, omitted. The Australian wheat variety, Thew, is now included in the list of differential host varieties. Race 26, originally described by W. L. Waterhouse as Aust. 2 [ibid., xi, p. 629], readily attacks Thew, while race 95 is identical with 26 except that it cannot fruit on Thew (type 0). Races 96 and 97, described by Waterhouse as A and B [loc. cit.], respectively, are almost identical with race 68.

GASSNER (G.) & FRANKE (W.). **Untersuchungen über den Stickstoffhaushalt rostinfizierter Getreideblätter. Ein Beitrag zum Problem der Teleutosporenbildung.** [Studies on the nitrogen economy of rust-infected cereal leaves. A contribution to the problem of teleutospore production.]—*Phytopath. Z.*, xi, 5, pp. 517–570, 12 graphs, 1938.

The object of the experiments herein fully described and tabulated

was to determine the influence of the brown and yellow wheat rusts (*Puccinia triticina* race 14 and *P. glumarum* races 1, 5, 6, 7, 9, 18, and 19) on the nitrogen economy of infected leaves [cf. *R.A.M.*, xiii, p. 755], and the relationship of the latter condition to teleutospore production by the pathogens.

In inoculation tests, leaves of varieties giving an immune or semi-immune reaction underwent little or no modification of the nitrogen content, but in the case of moderately severe to heavy infection there was a marked tendency in the diseased leaves to retain the assimilated nitrogen much longer than healthy ones; in extreme instances the normal abrupt fall after the attainment of the maximum did not occur at all, and by the end of the trials the nitrogen content of the diseased foliage was generally higher than that of the sound leaves. Similar but less pronounced changes followed inoculations giving rise to slight infection. The results obtained with both rusts were of the same order, but *P. triticina* seemed to exert a stronger influence than *P. glumarum* on the nitrogen content of diseased plants.

These observations necessitate a complete change of outlook as regards the nature and origin of teleutospore production. The view of this process as a reaction of the rust to exhaustion of the host is no longer tenable, since externally wilted leaves contain a plentiful supply of nitrogen, which evidently plays an essential part in the development of the organs. The immediate stimulus to teleutospore formation is given by the gradual loss of water from the rusted leaves, which also involves the invading mycelium and is accompanied by a significant increase of nitrogen. Some light is further thrown by these data on the conditions governing the development of the uredo stage of the rusts, which must necessarily be opposed to those favouring teleutospore production and entail a high degree of atmospheric humidity.

Straib (W.). **Über den Einfluss der Steinbrandinfektion auf das Gelbrostverhalten des Weizens.** [Concerning the influence of bunt infection on the reaction of Wheat to yellow rust.]—*Phytopath. Z.*, xi, 6, pp. 571–587, 1 fig., 1938.

In a study on the reaction of wheat infected with bunt (*Tilletia tritici*) [*T. caries*] to yellow rust (*Puccinia glumarum*), increased susceptibility to yellow rust following inoculation with *T. caries* was observed almost exclusively on wheat varieties of 'labile' [= unstable] summer resistance [*R.A.M.*, xiii, p. 756] in the later stages of development of the plant (from the beginning of earing and especially after flowering), whereas no influence was perceptible in seedlings or young plants or in immune wheat varieties, and little or none in wheats of 'stable' summer resistance. Susceptible wheat varieties were not rendered still more susceptible by bunt infection. The enhanced susceptibility to yellow rust of bunted wheat varieties showing labile summer resistance varied considerably in different years and in different varieties. It is concluded that the use of bunt-infected wheats for testing their reaction to yellow rust in breeding work may be of some value for varieties showing labile summer resistance, but that it does not generally appreciably facilitate the work of selecting resistant varieties.

MARTIN (J. F.). **Effect of seed disinfection and delayed sowing on the control of bunt in infested soil.**—*J. Amer. Soc. Agron.*, xxx, 10, pp. 870–877, 1938.

In four years' tests on bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*] control in wheat (Hybrid 128) sown in artificially infected soil in Oregon, new improved ceresan was superior to the other disinfectants used [*R.A.M.*, xvii, p. 666]. Applied at the rate of 3 oz. per bush., it reduced infection by 66·3 and 74·8 per cent. in 1933–4 and 1934–5, respectively, as compared with 100 per cent. infection in the controls. At this concentration, however, a considerable reduction in stand was liable to result from the treatment. The ½ and 1 oz. rates of application decreased the incidence of bunt by 47·5 and 52·3 per cent., respectively. Treatment three weeks before sowing caused no consistent loss of efficacy.

When sowing was not delayed more than 24 hours, ethyl mercury iodide was about equal to new improved ceresan, reducing infection on an average by 47·7 per cent. in 1936 at ½ oz. per bush., but a distinct decline in efficacy was observed when ten days elapsed between the treatment and sowing.

Copper carbonate and copper sulphate were equally effective in combating soil-borne infection [ibid., xviii, p. 14], while the former reduced the amount of bunt in the crop by 22·3 to 31·5 per cent. during the four years of the trials (4 oz. per bush. in the first two years and 3 oz. in the last).

In 1933–4 formaldehyde (1 in 384) gave as good control of bunt as the two copper dusts in 1933–4, but these results were not substantiated during the next two seasons, when only 4·4 and 10·3 per cent. reduction were obtained.

Percentages of bunt were significantly lower when the wheat was sown the day the soil was inoculated and watered than when a week or ten days were allowed to elapse before sowing [presumably owing to the inhibiting effect on the germination of bunt spores of saturated soil]. Under the conditions of the experiments, a period of 50 to 60 days between soil inoculation and sowing was usually required before sufficient spores were destroyed to eliminate the risk of disease from heavy infection, though low temperatures occasionally operated to prevent this development. Low infection percentages were obtained in untreated controls sown 60 days or more after the inoculation of the soil with bunt spores. The seasonal trend of infection was very similar in treated and untreated material. This evidence indicates the delay in sowing, after the beginning of favourable moisture conditions in the autumn, necessary to reduce infection to the minimum.

GASSNER (G.). **Ueber Partialinfektionen von Weizenkörnern durch Tilletia und die Entstehung der Steinbrandbutten.** [On partial infections of Wheat grains by *Tilletia* and the development of bunt balls.]—*Phytopath. Z.*, xi, 5, pp. 451–467, 7 figs., 1938.

The Turkish 218/19 wheat harvest of 1935 yielded a high proportion of semi-bunted grains, representing every phase of infection by *Tilletia foetens* from the slightest degree of involvement to complete bunt balls,

and affording an opportunity to trace the various steps in the development of the latter.

In every case the spores emerged from the inner layers of the pericarp. Invasion of the ovule could not be demonstrated and is evidently precluded by the suberized seed coat. The ovule perishes, however, either through mechanical displacement by the bunt balls arising in the inner pericarp layers, or through the prevention of normal fertilization, but in no case, as hitherto surmised, by actual infection of the organ itself. The semi-bunted grains of wild wheats, with their germinable but heavily infected seeds basally enveloped by spores, may well play an important part in the uniform distribution of both host and parasite. Field experiments with semi-bunted grains showed that the spores surrounding the embryo were capable of infecting the emerging seedling to the extent of 8·7 per cent.

Semi-bunted grains cannot be eliminated from the harvest either by mechanical means or by washing or immersion, but in a test on 150 selected grains partial infection was reduced from 8·7 to 0 per cent. by half-an-hour's immersion in 0·15 per cent. germisan or dusting with ceresan.

Further observations in the summer of 1937 fully confirmed the previous year's conclusions as to the exclusive origin of the bunt balls in the pericarp. The copious formation of chlorophyll in the pericarp layers of bunted grains points to a modification in the normal metabolic processes in the direction of increased nitrogen assimilation, a fact to be remembered in attempts to interpret the well-known phenomenon of the enhanced susceptibility to rusts [*Puccinia* spp.: see above, p. 300] of bunted plants.

GASSNER (G.). **Ueber Auftreten und Verbreitung von Tilletia tritici und Tilletia foetens in der Türkei.** [On the occurrence and distribution of *Tilletia tritici* and *Tilletia foetens* in Turkey.]—*Phytopath. Z.*, xi, 5, pp. 469–488, 1 fig., 1 map, 1938.

Out of 2,272 bunted wheat ears originating in 29 vilayets [administrative divisions] of Turkey, 2,003 (88 per cent.) were found to bear *Tilletia foetens* [see preceding and next abstracts] and 274 (12 per cent.) *T. tritici* [*T. caries*], the predominance of the former species, especially in Anatolia, confirming previous observations on its preference for a continental climate [*R.A.M.*, xiv, p. 502]. The significance of sporadic anomalies in the local distribution of the disease remains obscure.

The average incidence of bunt in the Ankara division in 1935 was 16·8 per cent., the corresponding figure for 28 others being 15·5 per cent.; from occasional observations in 1936 the incidence of the disease was estimated at 22·7 per cent. The annual reduction of the Turkish wheat harvest through bunt is calculated at 400,000,000 kg.

Five ears from fields infected by *T. foetens* and *T. caries* were found to contain both species; as a rule the diseased grains yielded either one or the other, but occasionally the two were intermingled in one bunt ball. Eight out of 2,000 ears from widely separated districts contained spores of *T. caries* differing markedly from the normal in their exceptionally fine reticulation and the shortness of the surrounding ridges (invariably below 0·5 μ, sometimes only 0·3); the new transitional form

is provisionally named *T. tritici* f. *intermedia*. Various factors, including the circumstances of its occurrence, the appearance of the spore wall, and limited observations on the progeny of spores of the intermediate type, suggest that the new form arose through hybridization between the two bunt species [ibid., xvii, p. 665].

GASSNER (G.). **Untersuchungen über Keimgeschwindigkeit und Infektionsvermögen verschiedener Stämme von Tilletia foetens und Tilletia tritici.** [Investigations on the rapidity of germination and infection capacity of various strains of *Tilletia foetens* and *Tilletia tritici*.]—*Phytopath. Z.*, xi, 5, pp. 489–516, 1938.

Generally speaking, the wheat bunt (*Tilletia foetens* and *T. tritici* [*T. caries*]) spores from different grains of the same ear germinate at the same rate, whereas marked divergences in the rapidity of the process are observed among spores from different ears of the same collection. So constantly were these relationships maintained in recent comparative experiments in Turkey that it seems permissible to regard the spores of a single ear as a 'strain'. The fact that the germination rate of the spores of individual ears is an inherent character was demonstrated by laboratory tests in 1934 and 1935 on the progeny of 25 races of *T. foetens* from Ankara and 7 of *T. caries* from Sazova (Turkey) and Brunswick (Germany), the results of which disclosed a far-reaching correspondence between the parent races and their offspring in respect of this feature. Occasional discrepancies are attributed to the presence of more than one 'race' in the parent ear. Besides germination rate, other characteristics of the spores and spore powder and peculiarities of the germinating mycelium were found to be linked with individual bunted ears and their progeny.

The outcome of field experiments fully confirmed the above-mentioned interpretation of individual bunted ears as distinct 'strains'. The infective capacity of the spores of a bunt population derived from individual bunted ears varied far beyond the limits of experimental error. Moreover, the 'aggressiveness' of the spores from the individual ears of two test varieties of wheat (*vulgare* 85/30 and *durum* 211/29) was variable and to some extent conflicting, so that the strains in single ears evidently represent physiologic races.

Although no definite correlation could be discerned between the germination rate and virulence of the spores of individual strains, a higher incidence of infection on 85/30 was generally secured with rapidly germinating spores, while conversely, those germinating relatively slowly were more severe on 211/29; this difference appears to be related to the fact that 211/29 takes much longer to germinate than 85/30.

SNELL (K.). **Die Prüfung der Widerstandsfähigkeit von Getreide- und Rübensorten.** [The testing of resistance of cereal and Beet varieties.]—*Angew. Bot.*, xx, 6, pp. 446–453, 1938.

The following methods have been found useful in studies at the Biological Institute, Dahlem, Berlin, on the varietal resistance of wheat and oats to bunt (*Tilletia tritici*) [*T. caries*] and loose smut (*Ustilago avenae*), respectively. In the wheat tests the grains, after agitation in an Erlenmeyer flask with a weighed quantity of spores, are sown in

pots (30 per pot) filled with a suitable mixture of soil, 80 to 100 plants of each variety being sufficient for the determination of resistance. In the case of summer varieties the temperature should be maintained at 16° to 17° C. during germination, after which the seedlings are transferred to the greenhouse and kept at 20° under constant (day and night) illumination. Earing in early varieties takes place in about six weeks, by which time the spores can easily be extracted from the ovaries both of the fertilized and unfertilized flowers. The time required to reach a comparable stage in the field averages about six months, and the infection percentages thus obtained are much lower than in the greenhouse (on the Peragis variety 39·8 and 25·5 per cent. for collections VII and VIII of *T. caries*, respectively, against 100 and 87·6 per cent. and on the Endress variety 3·6, 1·9, 11·9, and 14·8 per cent., respectively).

Winter wheat grains are laid in shallow boxes and germinated at 10° in the dark, then transferred to daylight at 10° to 13° for further development (until completion of the first leaf), after which they are placed in a refrigerator (2° to 5°) and exposed for six weeks to eight hours' daily illumination by a 60-watt electric bulb. They are then transplanted in pots and maintained under the lengthened day conditions described for summer wheat.

The reaction of oats to *U. avenae* was tested by G. M. Reed's [ibid., xvii, p. 451 *et passim*] method of dehulling the grains by ten minutes' soaking in alcohol, followed by immersion in water, shaking up with spores in an Erlenmeyer flask, sowing in pots in soil of 25 per cent. water-holding capacity, and germinating in the cellar at 20°. On the emergence of the coleoptiles the plants were divided into two series, one of which was kept in the greenhouse with supplementary illumination, while the other was planted out in the open. Comparable results were secured in both lots in 1937.

The other experiments described relate to certain physiological characters in cereals and beets.

Crépin (C.), Bustarret (J.), & Chevalier (R.). **La résistance des variétés d'Avoine au charbon nu.** [Resistance of Oat varieties to loose smut.]—*Ann. Épiphyt.*, N.S., iv, 3, pp. 391–412, 1938.

In a brief account from the literature of the loose smut of oats (*Ustilago avenae*) the authors state that this is the most widespread disease of the crop in France [*R.A.M.*, xviii, p. 17], mainly because seed disinfection is still largely neglected by the smaller growers. In varietal resistance tests carried out at the Agricultural Experiment Station at Dijon from 1932 to 1937, high resistance was shown by Red Algerian, Red Rustproof, Baxter, and Woodford (all belonging to *Avena byzantina*), Mesdag, Markton, Kherson, and Richland (*A. sativa*), and Fulghum, Kanota, Burt 1–8–3, Navarro, Myall, Early Kherson, Warrigal, and Lampton (*A. byzantina*×*A. sativa*). It is pointed out, however, that so far very little is known concerning the physiologic races of the smut in France, though the evidence at hand would indicate that Mesdag, Markton, Navarro, Richland, Burt 1–8–3, Early Kherson 4, and an Algérie×Lochow cross may prove to be valuable as parents for developing varieties resistant to most of the smut forms that occur in that country.

Crépin (C.), Bustarret (J.), & Chevalier (R.). **Nouvelles recherches sur la résistance des Blés aux caries.** [Further investigations on bunt resistance in Wheat.]—*Ann. Épiphyt.*, N.S., iv, 3, pp. 413–447, 4 graphs, 1938.

In continuation of their studies on wheat bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*: *R.A.M.*, xviii, p. 13] at Dijon, the authors found that in resistant wheat varieties seedling mortality induced by artificial inoculation of the seed with the local physiologic race of bunt did not exceed 22 per cent. either in the autumn or in the spring, and was fully compensated by a more abundant tillering of the surviving plants, the yield of which was equal to that of the uninoculated controls. Comparative tests with four bunt collections from France, one from Switzerland, three from Germany, and one from the United States, again confirmed the lower virulence of the French collections towards both winter and spring wheats. Immunity from, or very high resistance to, all the bunt collections tested was found in the autumn varieties Hohenheimer 77 (German), Hosar, Oro, Turkey, 7·366, Ashkof (American), and in the pure line 4 developed from Ridit at Dijon; two other pure lines (3 and 10) of this wheat were somewhat less resistant to certain of the bunt collections. All these varieties may be safely sown without seed disinfection. *Triticum timopheevi* showed no bunt infection in any of the tests. The American autumn varieties Hussar, Martin, and White Odessa were resistant to the French collections but more or less susceptible to the collections from Zürich, Cosel, and Breslau; the Hungarian variety Magyarovar 1, the Swiss Baulmes 6–1, and a selection of a local wheat from the Jura (Gillois 1) proved resistant to the Dijon collection, but variously susceptible to the other French collections. Of the spring wheats tried the American Hope alone was highly resistant to all the collections, and was followed by H 44–24, Hope×Reward, Hope×Reliance (lines 1–2 and 2–7–2), H 44×Marquis, and Marquis×Emmer; a still less resistant class includes Marquis, Pentad×Marquis, Marquillo, Garnet, Dindiloa, Aurora, Extra-Club II, and Florence 135, the last-named of which appeared to be more resistant to the foreign than to the Dijon collection. The Dijon and Versailles collections were effectively separated by screening from races virulent towards the Baulmes and Hope×Reliance varieties, and from a race very virulent to Martin.

Further work on the genetics of resistance indicated that the Gillois I wheat has only one recessive factor for resistance to the Dijon bunt collection, while the line 9–9–1 developed at Dijon from Martin×K3 has two factors, one of which is dominant, for resistance to this collection. The fact that this line appears to have inherited some of the factors for resistance from the Martin parent, while differing from it in its external aspect and in its cultural characters, is considered to indicate that bunt resistance is inherited independently of morphological or physiological characters, a view confirmed by the results of all the crosses studied at Dijon; it is claimed to have allowed the authors to combine in their hybrids the resistance of parents such as Hussar, Martin, Baulmes, and Ridit with desirable cultural characters inherited from susceptible parents.

Selariès (P.). **Essais sur la carie du Blé en Alsace, Tilletia tritici (Bjerk.) Wint.** [Experiments on Wheat bunt in Alsace, *Tilletia tritici* (Bjerk.) Wint.]—*Ann. Épiphyt.*, N.S., iv, 3, pp. 481–484, 1938.

In giving an account of further experiments on wheat bunt [*Tilletia tritici*) [*T. caries*: *R.A.M.*, xviii, p. 12] at Colmar, the author states that the results in 1937 showed that local collections of bunt are more virulent on the susceptible wheat varieties B2 and Bon Fermier than the collections from Breslau, Cosel, Halle, or Zurich; the propagation of the latter collections through several consecutive years on a susceptible variety did not result in their increased virulence to that variety, and the passage of a given collection through a resistant variety did not appear to increase its virulence to susceptible wheats.

Prévost (B.). **Memoir on the immediate cause of bunt or smut of Wheat, and of several other diseases of plants, and on preventives of bunt.**—Translated from the French by G. W. Keitt.—*Phytopath. Class.* 6, 95 pp., 3 pl., 1 fig., 1939. $0·75.

This translation of Bénédict Prévost's memoir is supplemented by a foreword, biographical sketch, and evaluation of the memoir by the translator, who regards the work, originally published in 1807, as the first recorded adequate experimental demonstration of the role of a micro-organism in the causation of disease. Besides accurately describing the symptoms of wheat bunt [*Tilletia caries* and *T. foetens*: cf. *R.A.M.*, xvi, p. 799], Prévost conducted successful inoculation experiments to establish its cause and to define the conditions favouring infection, and conducted toxicological studies in which he discovered that copper salts would prevent germination of the spores of the bunt fungus. On the basis of these results he carried out field trials on the control of the disease by steeping the seed wheat in a copper sulphate solution and gave detailed recommendations for carrying out this treatment on a large scale.

Rosen (H. R.) & Weetman (L. M.). **Factors affecting the longevity of urediospores of Puccinia coronata avenae.**—Abs. in *Phytopathology*, xxix, 1, p. 21, 1939.

Leaves of oats heavily infected by the uredo stage of crown rust (*Puccinia coronata avenae*) [*P. lolii*: *R.A.M.*, xviii, p. 242] were collected in June of two successive years and kept at various combinations of temperature (5° to 40° C.) and relative humidity (0 to 90 per cent.). Under outdoor conditions, with or without control of humidity, the spores were short-lived, but they remained viable and infectious for a year at 5° to 10° and 25 to 50 per cent. relative humidity. At 15° and 25 per cent. relative humidity, a small percentage of spores remained viable for nearly a year, while at 15° and 50 per cent. viability was retained for six months. The spores rapidly succumbed at temperatures above 15° at all the humidities tested. These data are considered to indicate that the uredospores of *P. lolii* are not instrumental in the perpetuation of the rust from year to year in Arkansas or any important oat-growing area of the United States.

Johann (Helen). **Scolecospores in Diplodia zeae.**—*Phytopathology*, xxix, 1, pp. 67–71, 3 figs., 1939.

The writer has recently obtained scolecospores in agar cultures of *Diplodia zeae* isolated from rotted maize kernels [*R.A.M.*, xviii, p. 244] (*a*) collected in the field in Ohio in 1934, and (*b*) inoculated with the Ohio strain in the field at Madison, Wisconsin, in 1937. The scolecospores are hyaline, filamentous, 21 to 45 μ in length (mostly 25 to 35 μ), borne in fruiting bodies resembling the usual submerged pycnidia or in simple to lobulate and cup-shaped structures supported in pseudoparenchyma on the surface of the plate. Fructifications containing brown, bicellular pycnospores and those giving rise to scolecospores occur separately or in close proximity, and in some instances the two spore types, more or less segregated, have been observed in a single pycnidium. The conditions favouring scolecospore production are not altogether clear, but the presence in a culture of an averting strain of the fungus appears to stimulate the development of these organs, which grow best in subdued light and in tightly capped flasks. The scolecospores of *Hendersonina sacchari*, pathogenic to sugar-cane in India [ibid., xv, p. 703], closely resemble those of *D. zeae*, and the question of the possible relationship of the two organisms requires further consideration.

Schropp (W.) & Arenz (B.) **Über die Wirkung von Bor und Mangan auf das Wachstum der Maispflanze.** [On the effect of boron and manganese on the growth of the Maize plant.]—*Phytopath. Z.*, xi, 6, pp. 588–606, 8 figs., 1938.

The effect of boron and manganese on the growth of maize plants was studied by the writers at Weihenstephan, Bavaria, in water and sand culture experiments, the elements being added to the nutrient media at a rate equivalent to 0·1 mg. per l. Maize plants grown without the addition of boron showed delayed growth, chlorotic foliage, long, white, transparent streaks on the leaves, abortive paniculation and ear formation, and lack of stamina; microscopic examination revealed further abnormalities of the leaf structure. The experimental symptoms of manganese deficiency also included delayed growth and severe chlorosis, but the reproductive system was not affected. Data are also given on the effect of boron and manganese on the chemical composition of the maize plant.

Carrante (V.). **La 'fetola' delle Arance e dei Mandarini.** ['Fetola' of Oranges and Mandarins.]—*Boll. Staz. Agrum. Frutt. Acireale*, 71, 7 pp., 3 figs., 1938.

At the commencement of the export season of 1938–9, oranges and mandarins in Sicily were widely affected by a type of blemish, referred to locally as 'fetola' and stated to be the same as oleocellosis [*R.A.M.*, xvii, p. 106]. In some groves all the fruits were attacked, but the condition was not observed on lemons. The areas of the fruit surface most commonly affected were those exposed to the north wind, those rubbing against other fruits, and the basal parts generally; the part near the peduncle remained unaffected. The Ovale and Calabrese orange varieties appeared to be immune. The prevalence of the condition may be reduced by improved cultural conditions and greater care in picking.

Baker (R. E. D.). **Report on a visit to Puerto Rico.**—*Proc. agric. Soc. Trin. Tob.*, xxxviii, 12, pp. 483–496, 1938.

The author reports the following diseases of grapefruit observed on his visit to Puerto Rico. Melanose, caused by *Phomopsis* [*Diaporthe*] *citri* [*R.A.M.*, xviii, p. 238], attacks both foliage and fruit, but apparently causes little damage; a common and serious disease is mottle leaf [loc. cit.], attributed to zinc deficiency, against which some of the estates have successfully incorporated one zinc sulphate-lime spray in their annual spray programme; gummosis (*Phytophthora* spp.) [loc. cit.] does a good deal of damage; while psorosis [ibid., xviii, p. 248] is not serious.

Scab (*Elsinoe fawcetti*) [ibid., xvii, p. 729] is stated to be present in varying degrees of severity in all areas, spoiling up to 50 per cent. of the fruit in seriously affected districts, where, it has been observed, the fruit is much more affected than the leaves. Generally scab is most important in areas of high rainfall and poor drainage, mild in those of low rainfall and good drainage, and of medium intensity in those of high rainfall and good drainage. The chief commercial varieties, Duncan and Marsh Seedless, are both very susceptible, whereas two specimens of Triumph, growing near severely diseased trees, showed no infection. Scab was also common on lemons, on the King orange, and on an unidentified orange of the mandarin type. Spraying in Puerto Rico is done almost entirely by power sprayers. A typical spray programme for areas lightly infected with scab includes the application of lime-sulphur at, or just after, the flowering stage, and again four to six weeks later, and in addition one zinc sulphate spray against mottle leaf; while that for heavily infected areas comprises a lime-sulphur or oil spray before flowering, Bordeaux (3–3–50) at petal fall, followed by an oil spray as soon as possible, lime-sulphur for rust mite control, again four to six weeks later, and a zinc sulphate spray against mottle leaf. The most essential time for spraying is just after blossoming but a reasonable degree of control can apparently be obtained as late as twenty days after petal fall, or even when the fruit is the size of a pea.

Nowell (W.). **Internal boll disease.**—*Emp. Cott. Gr. Rev.*, xvi, 1, pp. 18–24, 1939.

In this paper the author reviews the present state of knowledge on internal boll disease of cotton (associated with *Nematospora* [*coryli*], *N. gossypii*, *N. nagpuri*, *Eremothecium ashbyi*, *Spermophthora gossypii*, and other organisms, including bacteria) [cf. *R.A.M.*, xv, p. 719; xvi, pp. 35, 455; xviii, p. 248] and indicates the lines along which further investigation should proceed. The chief points still requiring elucidation are whether the insects responsible for the punctures by which the pathogens enter are the actual vectors of the organisms involved, and if so, the mechanism of such transmission.

Owen (O. P.). **Blue stain of Cotton caused by fungi.**—*Tech. Bull. N.C. agric. Exp. Sta.* 59, 12 pp., 2 figs., 1938.

In March, 1936, cotton left exposed throughout the winter in Piedmont and the Upper Coastal Plain of North Carolina showed a deep blue stain. Small pieces of fibre cut from the affected samples were grown on a sweet potato medium at 25° C. for ten days, at the end of

which period some 20 fungi were isolated and inoculated into clean, white cotton treated with 1/40, 1/20, and 1/10 molar solutions of dextrose. After three weeks at 28° two stains were outstanding, a yellow and a dark blue; the latter closely resembled that observed in the field and the causal fungus was further studied.

The mycelium on sweet potato is white with a faintly greenish tint at first, turning bluish- or greyish-black; on maize and oatmeal agars the characteristic colours are greenish and white or yellowish, respectively. The conidiophores are olivaceous, septate, mostly simple, and produce at their apices single or concatenate, dark brown, mostly non-rostrate, longitudinally and transversely septate conidia, measuring 15 to 63 by 9 to 20μ on filter paper and 15 to 31 by 12 to 18μ on cotton cloth. The fungus is identified as a species of *Alternaria* quite distinct from *A. gossypina* [*R.A.M.*, xvii, p. 674].

In inoculation experiments on sterilized slivers of mature cotton in distilled water in test tubes the blue stain began to appear in about three weeks and proceeded to discolour the whole contents of the tube. After three months or so a few spores developed. When nearly mature green bolls were inoculated in the laboratory, intensive staining occurred in five days. In baled cotton inoculated by placing an *Alternaria* culture in the centre of the mass, a uniform blue discoloration was found to have developed in a bale left in the field after 64 days' exposure, whereas one similarly treated and kept in a shed was not noticeably affected. After 174 days' storage in the laboratory a certain amount of staining was apparent in inoculated bales, but the discoloration was much less intense than that observed in the field tests. Definite staining also occurred in both bagged and unprotected bolls in the field 13 days after inoculation; overcast or rainy weather prevailed during the period of the tests, with average minimum and maximum temperatures of 61° and 74° F., respectively, corresponding almost exactly with the conditions favouring the growth of the fungus in culture. All attempts at the infection of greenhouse seedlings and field plants gave negative results.

Wallace (G. B.). **Plant diseases spread by bugs.**—*E. Afr. agric. J.*, iv, 4, pp. 268–271, 1939.

A complete list, revised to 1937, is given of the host plants of *Nematospora gossypii* [*R.A.M.*, xvi, p. 455; ; xviii, p. 248], *N. coryli* [ibid., xvi, pp. 35, 597; xvii, pp. 162, 300; xviii, p. 248], *Spermophthora gossypii* [ibid., xiv, p. 693], and *Eremothecium cymbalariae* [ibid., xii, p. 566], showing the distribution of these fungi. Mention is also made of *N. nagpuri* on cotton in India [loc. cit.]. Notes are given on the diseases caused by fungi of this group on coffee, cotton, and legumes, and on methods of control.

Lepesme (P.). **Influence de la température et de l'humidité sur la pathogénie de l'aspergillose des Acridiens.** [The influence of temperature and humidity on the pathogenicity of aspergillosis of Acridians.]—*C.R. Acad. Sci., Paris,* ccviii, 3, pp. 234–236, 1 graph, 1939.

Further studies on the environmental factors involved in the development of the epidemic among migratory locusts (*Schistocerca gregaria*)

caused by *Aspergillus flavus* at the Central Laboratory of Acridian Biology, Paris [*R.A.M.*, xvii, p. 675] showed that a maximum temperature of 18° C. and a minimum humidity of 55 per cent. are necessary for the germination of the conidia, while the optimum temperature for mycelial growth ranges from 32° to 35°. Practically speaking, the fungus is pathogenic at 35° with a minimum humidity of 70 per cent. and highly so above 80 per cent. (death of the insects in three days); between these two limits other factors, as yet unknown, intervene to cause individual variations in the degree of resistance manifested.

Roubaud (E.) & Deschiens (R.). **Capture de larves infectieuses de Nématodes pathogènes par des champignons prédateurs du sol.** [The capture of infectious larvae of pathogenic Nematodes by predacious soil fungi.]—*C. R. Acad. Sci., Paris*, ccviii, 4, pp. 245–247, 1939.

The writers obtained from J. Comandon and P. de Fonbrune cultures of the nematode-destroying fungi *Arthrobotrys oligospora* and *Dactylella bembicodes* [*R.A.M.*, xviii, p. 251] and tested, under controlled experimental conditions, the capacity of those organisms for the capture of larvae of *Strongyloïdes fülleborni* and *Ankylostoma duodenale*, intestinal parasites of the chimpanzee and man, respectively. The fungi were found to produce their typical organs of capture within 48 hours and to entrap and ingest the nematodes exactly as in nature. The relatively large dimensions of the larvae (300 by 560 by 14 to 24μ in the case of *S. fülleborni*) apparently presented no obstacle to the predacious activities of the fungi with their mycelium of only 3 to 6μ in diameter.

Turu (H.). **Inokulationsversuche von Blastomyces am Mundwinkel von Mensch und Tier.** [Inoculation experiments with *Blastomyces* at the corners of the mouth on man and animals.]—*Fukuoka Acta med.*, xxxi, 9, pp. 1530–1540, 1 pl., 1938. [Japanese, with German summary on pp. 158–159.]

The pathogenic yeasts (*Blastomyces*) isolated from a typical case of perlèche at the Hukuoka University Dermatological Clinic, Japan, [*R.A.M.*, xvii, p. 528] were inoculated into the corners of the mouths of human subjects, rabbits, and guinea-pigs with positive results (especially marked in the case of the first-named) and recovered in pure culture from the affected areas.

Montgomery (R. M.), Hopper (Mary E.), & Lewis (G. M.). **Favus involving a toe nail.**—*Arch. Derm. Syph., Chicago*, xxxviii, 6, pp. 856–858, 1938.

Infection by *Achorion schoenleini* is stated to be relatively uncommon in New York, where only 18 out of 74,046 patients admitted to the Skin and Cancer Unit during the period 1935 to 1937 were affected by favus due to this organism. The present paper deals briefly with a case in a 28-year-old woman of active involvement of the right toe-nail, from which *A. schoenleini* was isolated, accompanied by evidence of healed lesions from the same source on the scalp and left thumb-nail.

ARGENZIANO (G.). **Favo primitivo del braccio.** [Primary favus of the arm.]—*Rif. med.*, liv, 18, pp. 696, 699–700, 1 fig., 1938.

Clinical details are given of a case of primary favus of the right forearm in a 32-year old woman at Naples, contracted from her two children suffering from the same disease of the scalp. The organism isolated from the infected tissues was grown on Sabouraud's glucose and maltose agars and developed the typical features of *Achorion schoenleini* [*R.A.M.*, xvi, p. 610 *et passim*]. Inoculation experiments on guinea-pigs with material from mother and children gave positive results, and the fungus was recovered from the erythemato-squamous lesions thus induced.

CASTELLINO (P. G.). **Eczematidi figurate in rapporto al Microsporon furfur.** [Figurate eczematids in relation to *Microsporon furfur*.]—*Rif. med.*, liv, 17, pp. 653–656, 2 figs., 1938.

Clinical details are given of two Neapolitan cases of figurate eczematids secondary to the typical manifestations of pityriasis versicolor and yielding to appropriate treatment of the original foci of infection, due to *Microsporon* [*Malassezia*] *furfur* [*R.A.M.*, xvii, p. 678].

SZATHMÁRY (S.). **Das Epidermophyton luteum und seine Varianten.** [*Epidermophyton luteum* and its variants.]—*Arch. Derm. Syph., Berl.*, clxxviii, 3, pp. 216–224, 8 figs., 1938.

This is a very detailed account of the development on a number of standard media of cultures of an *Epidermophyton* isolated from the feet of two women at Pécs, Hungary, and characterized by pluriloculate (mostly 5), short-stalked spindles, 10 to 12 by 4 to 50 μ, spherical or piriform spores, 4 to 4·5 by 3·5 to 4 μ, chlamydospores 10 to 12 μ in diameter, and spirals 1 to 1·2 μ. The fructifications were arranged in spicate and botryose configurations. The fungus differs from the related *E.* Kaufmann-Wolf [*R.A.M.*, xvi, p. 809; xviii, p. 178] in various cultural characters, e.g., the sinuous and rimose central portion of the colonies with radiating furrows on maltose-containing substrata, the greenish-ochraceous colour, turning to purple in old cultures, the morphological peculiarities and canary-yellow tinge of peptone agar cultures, as well as in the positive outcome of inoculation experiments on guinea-pigs and human subjects. The fungus is named *E. luteum,* and two variants are described differing from the type in cultural characters.

SZATHMÁRY (S.). **Epidermophyton gypseum flavum.**—*Arch. Derm. Syph., Berl.*, clxxviii, 3, pp. 225–233, 6 figs., 1938. [German.]

From an inflammatory lesion on the right upper arm of a 16-year-old boy at Pécs, Hungary, the writer isolated a hitherto apparently undescribed fungus which he designates as *Epidermophyton gypseum flavum*. Sabouraud examined the organism and placed it near *E. inguinale* [*E. floccosum*] but drew attention to some important cultural and morphological differences between the two, to which must be added the ready transmission of *E.g. flavum* to animals and human subjects.

On 4 per cent. Sabouraud's maltose agar the fungus formed greyish-white, velvety colonies, with piriform, occasionally elongated or oval,

biloculate spindles, 16 to 18 by 10 to 12 μ, and piriform conidia arising laterally from the aerial hyphae, 6 to 7 μ by 2 to 3 μ. On peptone at 20° C. the colonies were crateriform, sulcate, and greyish to greenish-yellow; intercalary or terminal chlamydospores were sparsely produced. Both on maltose and peptone the cultures smelt of decaying albumin. On gelatine concatenate chlamydospores, 12 to 14 μ, developed in profusion in addition to the spindles. The colonies on potato agar were ochraceous, with a prominent centre and flat, whitish, parchment-like periphery. Besides spindles oidia arose through hyphal disintegration.

Szathmáry (S.). **Epidermophyton sulfureum.**—*Arch. Derm. Syph., Berl.*, clxxviii, 3, pp. 269–275, 5 figs., 1938. [German.]

A hitherto apparently undescribed *Epidermophyton*, herein designated *E. sulfureum*, was isolated from inflamed, scaling lesions and blisters on the right foot of a 17-year-old girl at Pécs, Hungary. On Sabouraud's 4 per cent. maltose-peptone agar the colonies at three weeks were of a dirty sulphur-yellow colour, rugose at the centre, pulverulent, becoming smooth and greenish-yellow towards the periphery, which was surrounded by a narrow, white border and delicate actiniform halo. Both on this medium and on glucose-peptone agar the fructifications of the fungus developed in the form of spicate and botryose structures, with a few spindles. In subcultures on peptone agar in Erlenmeyer flasks the spherical or oval, almost exclusively intercalary chlamydospores, 7 to 10 μ in diameter, were often arranged in chains and mostly contained yellow granules. The circular or shortly piriform conidia measured 4·4 to 6 by 2·2 to 3·5 μ. The mostly 7-loculate spindles measured 40 to 50 by 10 to 12 μ.

Inoculation experiments on guinea-pigs and human subjects gave positive results, with retroculture of the fungus.

Gammel (J. A.) & Work (J. L.). **Sycosis parasitica due to Favotrichophyton album var. singulare.**—*Arch. Derm. Syph., Chicago*, xxxviii, 5, pp. 756–772, 7 figs., 1938.

From the beard of a middle-aged cattle-dealer suffering from sycosis parasitica (probably resultant on contact with 'scabby' sheep) the writers isolated a fungus which they consider to be a form of *Favotrichophyton* (*Trichophyton*) *album* [ibid., xvii, p. 599], identical with the fungus *F.* (*T.*) *singulare* (Cazalbou) Dodge, and they accordingly refer it to *F. album* var. *singulare*. In culture on Sabouraud's dextrose agar plus beef liver infusion the fungus produced a luxuriant cerebriform growth which yielded on further culturing a discoid type of colony. This in turn gave rise to the cerebriform type in one set of transplants. In hanging drop cultures on Sabouraud's dextrose broth the hyphae of the cerebriform type measured 1·8 to 4 (average 2 to 2·4) μ, and the intercalary or terminal chlamydospores 8 to 14 μ in diameter. In the discoid type the hyphae were generally more slender and showed fewer lateral protuberances than the foregoing, but rudimentary pectinate organs could be detected. There were fewer chlamydospores than in the cerebriform type. All cultures emitted a strong odour of ammonia, and were capable of liquefying gelatine.

Epstein (S.). **Presentation of the hypothesis that Trichophyton interdigitale is a degenerated Trichophyton gypseum.**—*J. invest. Derm.*, i, 2, pp. 141–168, 6 figs., 1938.

Trichophyton interdigitale (syn. *Epidermophyton interdigitale* and Kaufmann-Wolf's fungus) is stated to be indistinguishable microscopically or by animal inoculations from *T. gypseum* [*R.A.M.*, xvii, p. 818; xviii, p. 178]. Serial animal passages produced marked changes of virulence in both species, in the direction of attenuation in *T. gypseum* and in that of increased pathogenicity in *T. interdigitale*. There is a close analogy between epidermophytosis of the hands and feet, associated with *T.* spp. of the *gypseum* group, including *T. interdigitale*, and true *T. gypseum* infections of the hairy areas. As a result of further study, the author claims that *T. interdigitale* is a degenerated form of *T. gypseum* on the basis of the following considerations: (*a*) the variability of fungi in general and the cultural similarity of *T. interdigitale* and *T. gypseum*; (*b*) the similar effects of both fungi on guinea-pigs; (*c*) the biological parallelism between the two species (production of skin hypersensitivity to trichophytin and of epidermophytids and trichophytids, and invasion of the lymphatic system and blood stream); (*d*) epidemiological evidence, showing that when a severe epidemic of deep trichophytosis in Germany due to *T. gypseum* subsided it was shortly followed by an even more widespread outbreak of epidermophytosis (*T. interdigitale*); (*e*) the typical interdigital epidermophytosis developing in a previously non-infected human volunteer after inoculation with *T. gypseum*, and the retention of the normal characters in retrocultures of the fungus following experimental human passage and the production of the symptoms commonly ascribed to *T. interdigitale*.

A three-page bibliography is appended.

Perrone (P.). **Micosi delle tonsille (da 'Cryptococcus pinoysimilis' Cast. 1933.)** [Tonsillar mycosis caused by *Cryptococcus pinoysimilis* Cast. 1933.]—*Pathologica*, xxx, 560, pp. 241–242, 1938. [German and English summaries.]

A fungus isolated on Sabouraud's agar from nodules on the tonsils of a 40-year-old man at Bari, Italy, and grown at 37° C. was identified as *Cryptococcus* [*Candida*] *pinoysimilis* [*R.A.M.*, xv, p. 651].

Seaver (F. J.). **Fungi of the human ear.**—*Mycologia*, xxx, 6, pp. 692–694, 1938.

A case in New York of mycosis of the outer ear [cf. *R.A.M.*, xviii, p. 179] caused by *Aspergillus nigricans* is reported to have been successfully suppressed by swabbing with 50 per cent. alcohol, an ointment being applied to prevent irritation.

Rentschler (H. D.) & Scheifley (C. H.). **Fungous infections of the sinuses.**—*Arch. Otolaryng., Chicago*, xxix, 1, pp. 146–150, 1939.

In connexion with a brief report of a case of infection of the left maxillary sinus in a 49-year old woman in Pennsylvania by *Aspergillus niger*, the writers discuss previous records of fungal invasion of the sinuses, of which the earliest are stated to date from 1791 in France.

BÉKÉSY (N. v.). **Über parasitische Mutterkornkulturversuche.** [On parasitic ergot cultivation experiments.]—*Zbl. Bakt.*, Abt. 2, xcix, 14–17, pp. 321–332, 5 figs., 3 diags., 1938.

After summarizing previous outstanding contributions to the subject of rye ergot [*Claviceps purpurea*] cultivation for pharmaceutical purposes by saprophytic and parasitic methods [*R.A.M.*, xvi, p. 447], the writer describes his own experiments at the Budapest Drug Plant Institute in the procurement of inoculum.

Ears of winter rye were inoculated with an ascospore emulsion of the fungus through the closed flowers by means of an atomizer, and 6 to 12 days later the sticky drops of honeydew appeared. These may be collected either with the aid of a suction-tube or by washing off, and preserved in suitable containers, e.g. a retort-shaped vessel or an Erlenmeyer flask, maintained at temperatures not exceeding 35° C., and if necessary cooled off at 0° to 4°. The trial area of 13·5 sq. m. yielded 1 l. honeydew, which on dilution for field work produced 60 l. inoculum with conidia numbering 5,000 per cu. mm.

In addition ergot inoculum may be obtained by a saprophytic culture technique, as elaborated by Falck (*Pharm. Ztg*, lxvii, Nos. 73–75, 77, 79, 1922) and Kirchhoff [*R.A.M.*, viii, p. 560], and by the overwintering of conidia from the *Sphacelia* layers for which a cool, fairly moist atmosphere is essential, germinability being otherwise lost after four months. The conidia are best liberated by the immersion of the layers in a linen bag in water. On an average 1 l. inoculum may be secured from 10 kg. ergot by this method.

Field inoculation experiments were carried out with a machine equipped with four sets of two vertical rollers. One roller, covered with felt, presses the ears against the other. The latter is fitted with hypodermic needles, through which the inoculum is conveyed to the rye flowers. Two great advantages of this mode of inoculation are its economical use of infective material and its applicability at an early stage, viz., as soon as the ears are formed, so that the natural spread of the fungus is promoted and honeydew is produced by flowering time. Although this method is entirely independent of weather conditions and flowering time, various factors contribute to its success or otherwise. In order that insects may assist in the spread of inoculum, the plots should be situated in a low-lying, humid area close to meadows. Uniform growth of the plants should be secured by dense sowing and judicious manuring. The inoculum should contain 5,000 conidia per cu. mm., since the drops retained by the needles are minute and excessive dilution may result in failure. The collection of sclerotia should be made about ten days before the rye reaches maturity, and may be carried out by children. The yield in the trial plots of cultivated rye ranged from 90 to 190 kg. per hect. (up to 310 kg. in one instance), the corresponding figure for *Secale montanum* being 435 kg. Attempts to extract the sclerotia from threshed rye gave very unsatisfactory results, involving a minimum loss of two-thirds of the ergot.

No risk of ergot epidemics results from intensive production on the lines herein indicated, since the spread of infection is very limited, extending only about 4 m. from the source, and the sclerotia are short-lived (barely two years) and readily destroyed by ploughing. In

modern milling practice, moreover, the ergot content of the grain is reduced to the negligible minimum of 0·1 per cent., which has been authoritatively declared to be non-injurious to health.

Van Beyma Thoe Kingma (F. H.) **Beschreibung einiger neuer Pilzarten aus dem 'Centraalbureau voor Schimmelcultures' (Holland). V. Mitteilung.** [Description of some new species of fungi from the Centraalbureau voor Schimmelcultures, Baarn, Holland. Note V.] *Zbl. Bakt.*, Abt. 2, xcix, 18–23, pp. 381–394, 6 figs., 1939.

Latin and German diagnoses are given of *Margarinomyces luteo-viridis* n. sp., *M. fasciculatis* n. sp., *M. hoffmannii n.* sp., all isolated from butter samples from Switzerland (the first-named also from Czechoslovakia), *Tilachlidium butyri* n. sp. from the same source (Denmark), *Scopulariopsis danica* n. sp. from an equine trichophytosis (Denmark), and *Penicillium humuli* from hops (Weihenstephan, Bavaria). An amended diagnosis of Laxa's genus *Margarinomyces* [*R.A.M.*, xiv, p. 471] is also given.

Rost (H.). **Untersuchungen über einige Krankheiten des Leins in Deutschland.** [Investigations on some Flax diseases in Germany.] —*Angew. Bot.*, xx, 6, pp. 412–430, 2 figs., 1 graph, 1938.

These laboratory studies were undertaken to throw light on some important points in connexion with the fungi attacking flax in Germany, where the cultivation of the crop has steadily expanded since 1933. The organisms were isolated from diseased flax stems on potato juice agar plates at 25° C. and either inoculated into unsterilized soil in pots, in which seed was subsequently sown, or sprayed in a spore emulsion over seedlings kept for three days under glass in a very damp atmosphere. The temperature requirements of the experimental fungi on potato juice agar were determined as follows: *Septoria linicola* (*Sphaerella linorum*) [*R.A.M.* xviii, p. 112] (Banat, Rumania), minimum, maximum, and optimum, 5°, 31°, and 20°, respectively; *S. linorum* (Argentine), 5°, 31°, and 22°; *Phoma lini* (Mark, Germany), 3°, 30°, and 25°; *Colletotrichum lini* [ibid., xviii, p. 256] (same origin), 8°, 32°, and 22°; *C. atramentarium* [ibid., xvii, pp. 96, 160] (Silesia), 9°, 33°, and 26°; *Fusarium avenaceum* and *F. culmorum* (Mark), 3°,32°, and 25° and 8°, 33°, and 25°, respectively; *F. lini* [ibid., xvii, p. 441] (Argentine and Uruguay), 9°, 33°, and 27°; *Botrytis cinerea*, 8°, 32°, and 23°; *P. lingam* from *Brassica* (Centraalbureau voor Schimmelcultures, Baarn) [ibid., xviii, p. 222] (included on account of recommendations in the literature not to plant flax immediately following cabbage), 9°, 31°, and 22°; and *F. oyxsporum* var. *aurantiacum* [ibid., xvi, p. 756; xvii, p. 368] from wheat in the Argentine, 9°, 32°, and 27°.

C. lini, one of the most virulent parasites of flax in Europe, Asia, and America, is widespread in Germany, where it is regarded as one of the main causes of 'soil sickness' in the crop. In the writer's inoculation tests it reduced germination by 90 to 100 per cent. Only slightly less extensive was the damage caused by *C. atramentarium* (80 to 90 per cent. decline of emergence), not hitherto recorded on flax. It was detected in association with *C. lini*, *F. avenaceum*, *F. culmorum*, *Alternaria tenuis*, and *B. cinerea* on plants rotting from the top downwards.

In the relatively cool climate of Germany, *F. lini* is of no great importance, and is in fact not represented among the European samples examined at the Biological Institute during the last decade. *F. redolens* [ibid., xvi, p. 434], isolated once from a German flax plant, caused a 75 per cent. loss of germination, while some of the surviving seedlings subsequently died of root rot. *F. avenaceum* was isolated not only from German samples, but also from a capsule of a flax plant of Russian origin; it caused a 50 per cent. reduction of germination in pot tests. *F. culmorum* is here reported for the first time as an agent of foot and root rot of flax, causing up to 100 per cent. loss among plants germinating under adverse weather conditions. *Gibberella saubinetii*, not hitherto described as a pathogen of flax, was isolated once from the straw of an Argentine sample. It proved to be very destructive in soil inoculation tests. Other species found on the rotted roots of older plants include *F. scirpi* and its var. *acuminatum*, associated with *F. lini* and *F. solani* on 'perennial' flax from Uruguay. *P. lini* is common on German flax, producing a dense coating of dark brown, bulbiform to spherical pustules, mostly measuring 0·15 to 0·34 by 0·12 to 0·27 mm. from the stem base up to a height of 10 cm. As in the case of other flax pathogens, the fungus is most aggressive during or shortly after germination, spares the surviving plants for a time, and recurs at the period of flowering and seed ripening, causing wilting and premature defoliation, while pycnidia are formed in masses on the stems. In inoculation tests germination was reduced by 40 to 60 per cent. *P. exigua* [ibid., xii, p. 372] was isolated in 1936 from a German plant, but has not yet been tested for pathogenicity. *P. lingam* caused losses of 80 to 100 per cent. in soil inoculation tests on flax. The damage caused by *B. cinerea* varies greatly according to the weather; an abrupt change from cool, moist to warm, humid conditions may entail the total loss of a stand from infection by this fungus. In the writer's tests the losses in 1936 amounted to 100 per cent., whereas in the exceptionally dry season of 1937 only 33 per cent. damage was sustained.

MIDDLETON (J. T.) & TUCKER (C. M.). **A disease of Gloxinia caused by Phytophthora cryptogea.**—Abs. in *Phytopathology*, xxix, 1, pp. 17–18, 1939.

Phytophthora cryptogea [*R.A.M.*, xvii, p. 181] was isolated from the dark brown, water-soaked, flaccid tissues of greenhouse *Gloxinia* (*Sinningia speciosa*) corms, stems, and leaves in California. Infection proceeds from the lamina to the petiole and, in severe cases, to the stem, the last-named (which may also be attacked in the absence of foliar symptoms) bearing sunken, water-soaked lesions of varying dimensions. Severely infected plants collapse and die. Diseased corms exhibit soft, depressed, superficial lesions, and in severe cases soft, dark brown, internal necrotic areas, 1 to 8 mm. in diameter, scattered irregularly throughout the tissues and not necessarily directly connected with the surface spots. Inoculation experiments with the fungus on the above-mentioned organs gave positive results. This is the first record of the disease in question in the United States, though an apparently identical rot has been reported from Europe [cf. ibid., xvi, p. 814].

Pape (H.). **Über fächerförmige Verbänderungen und gallenartige Sprossanhäufungen am Stammgrund von Chrysanthemum indicum.** [On fan-shaped fasciations and gall-like aggregations of shoots at the base of *Chrysanthemum indicum.*]—*Z. PflKrankh.*, xlviii, 12, pp. 598–604, 5 figs., 1938.

Three out of five *Chrysanthemum indicum* plants (Mona Davis variety) from a Kiel nursery, examined by the writer in 1937, bore a number of basal shoots characterized by an extreme type of fasciation; approximately terete at their site of insertion on the stem, they spread out fanwise at a height of 2 to 3 cm. from the base, the span of the 'fan' frequently covering 15 cm. while its diameter did not exceed 3 to 4 mm. Only a third of a quarter of these fan- or cockscomb-shaped shoots projected above soil-level; the subterranean portions generally gave rise to a number of shoots. The fasciated shoots were brownish to reddish-brown below soil-level, pink to whitish at the stem base, and the exposed parts pale green. Their surface was studded at regular intervals with small, triangular, scaly structures (obviously retrorse leaves), dark brown on the lower half of the shoot, colourless to whitish-green on the upper. The uppermost pectinate edge of the fasciated shoots frequently bore minute, green leaflets. The two remaining plants produced, in addition to fasciated shoots of the foregoing type, clumps of short, thick, fleshy shoots, with small, distorted, thickened leaves, as described by Williams and Miss Lacey from England under the name of 'leafy gall' [*R.A.M.*, xv, p. 724]. The German material was sent to Miss Lacey who isolated from it *Phytomonas fascians* [see next abstract], presumed to be the agent of 'leafy gall' of chrysanthemum and other plants in England and the United States [ibid., xviii, p. 160]. Although inoculation experiments would be necessary to secure definite proof, the same organism is in all probability implicated in the causation of the disease in Germany. *P. fascians* was also isolated by Miss Lacey from *Pelargonium zonale* plants (Rubin variety) originating in the same nursery as the fasciated chrysanthemums and exhibiting similar symptoms.

Lindfors (T.). **En för Sverige ny bakterios.** [A new bacteriosis for Sweden.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, 6, pp. 81–82, 1 fig., 1938.

A brief note is given on the host range of *Phytomonas fascians* (stated to include garden peas and strawberries besides a number of ornamentals) in connexion with the detection of the typical symptoms caused by this bacterium on *Chrysanthemum maximum* [see preceding abstract] in Sweden. Although cultural experiments have not yet been undertaken, the identity of the causal organism, new to the country, is scarcely in doubt, and energetic control measures should be initiated to prevent its further spread.

Brierley (P.). **Two distinct viruses from the mosaic complex in Lilium longiflorum.**—Abs. in *Phytopathology*, xxix, 1, p. 3, 1939.

From Easter lilies (*Lilium longiflorum*) with typical mosaic flecking [*R.A.M.*, xvii, p. 531; xviii, p. 182] a virus of the cucumber mosaic

group may be isolated in cucumber, reinoculated therefrom into tobacco, lily, and other hosts, and recovered by the ordinary rubbing methods. Inoculations from flecked lilies induce mottling and breaking of tulip flowers [ibid., xviii, p. 257]. No symptoms develop on cucumber inoculated with the virus from broken tulips, which does, however, cause mottling of lily seedlings in ten days. The inoculation of tulips with the virus from severely mottled lilies also results in breaking, whereas cucumbers do not respond. Breaking also followed the inoculation of tulips with infective material from symptomless lilies (except seedlings), but cucumbers again failed to react. *L. formosanum* seedlings, inoculated by rubbing, develop pronounced mottling in ten days in response to the one or more tulip components of the complex; in the case of the cucumber component the reaction is less clearly defined. The cucumber mosaic strain (resembling Price's) and the strong mottle virus (allied to McWhorter's latent lily virus) differ in other properties besides pathogenicity.

GEMMELL (A. R.). **The degeneration of Metropolitan Bent.**—*Phytopathology*, xxix, 1, pp. 95–102, 4 figs., 1939.

Particulars are given of an apparently new disease of Metropolitan bent grass (*Agrostis stolonifera*), quite distinct from the brown patch due to *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xvii, p. 186], in Minnesota and the neighbouring States. The leaves assume a greyish-brown discoloration at the tip and die off from the tip downwards. The roots of affected plants are abnormally short and brittle. As the disease progresses the dead bent is gradually replaced by *Poa annua*, giving a mottled appearance to the green, with the *Poa* growing erect among the remaining prostrate green bent and the brown, necrotic patches. The consistent survival of a few pale green plants gives rise to isolated light green spots in the midst of the brown areas and accounts for the popular name of 'freckle' for the disease. A comparison between the six-month-old root systems of the susceptible Metropolitan and the resistant Woodhill bents showed that the average root length of the ten longest of the latter was 17·7 cm. as against only 8·6 cm. in the former. The 'escaping' Metropolitan plants also had much longer roots than those succumbing to the disease, which is not amenable to control by mercurial compounds, aeration, or adjustment of the water schedule, and is thought to be caused by the deficiency of one of the accessory elements indispensable to plant growth.

KLEMM (M.). **Schadgebiete des Kleekrebses (Sclerotinia trifoliorum Eriks.) in Deutschland, Kleesamenanbau und Witterung.** [Zones of injury from Clover stem rot (*Sclerotinia trifoliorum* Eriks.) in Germany, cultivation of seed Clover, and weather conditions.]—*Z. PflKrankh.*, xlviii, 12, pp. 605–618, 1 graph, 4 maps, 1938.

During the nine-year period from 1928 to 1936 the estimated reduction in the German clover harvest (based on official statistics) from stem rot (*Sclerotinia trifoliorum*) [see above, p. 299] amounted to roughly 40 per cent., corresponding to a financial loss of approximately RM. 47,000,000. A study of the maps of the distribution of the disease from 1925 to 1936 shows that 94 out of the 554 severely infected zones (16·9

per cent.) suffered heavy damage five or more years in succession; these were mostly situated in the principal clover-growing districts in north and central Germany, with sporadic foci in the south. This is a matter of serious concern since the best red clover [*Trifolium pratense*] seed comes from the north-east. Moreover, even the largest German harvests are quite inadequate for the needs of the country, and in Italy, the main source of supplementary imports, the damage from stem rot is six times as high as in Germany.

Although the chief zones of infection by *S. trifoliorum* are situated on loam, clay, and loess soils, no definite correlation could be established between soil constitution and the incidence of stem rot. On the other hand, there is no doubt that red clover does not respond favourably to improvement of the soil by loosening its texture, and in fact often thrives exceptionally well in seasons following a wet autumn, when the crop is liable to be trampled down by livestock. Stem rot is seldom observed in sheep-grazing regions. A decisive factor in the development of *S. trifoliorum* is the occurrence of abnormally high winter temperatures, especially in November, though October, December, and March are also of some importance in this connexion. No great influence on the course of the disease appears to be exerted by the amount of precipitation during the winter or the duration of the snow cover in March and April, but an abnormally large number of dull days in the former month predisposes the crop to infection.

SMITH (O. F.). **Host-parasite relations in Red Clover plants resistant and susceptible to powdery mildew, Erysiphe polygoni.**—*J. agric. Res.*, lvii, 9, pp. 671–682, 4 figs., 1938.

The results of cytological investigations under greenhouse conditions at the Wisconsin Agricultural Experiment Station showed that the early stages of infection by *Erysiphe polygoni* [*R.A.M.*, xvii, p. 754] were the same on susceptible, moderately resistant, and highly resistant *Trifolium pratense* plants, on all of which the appressoria formed by the germinating spores directly penetrated the epidermal cells of the leaves, the early steps of penetration being accompanied by an ingrowth of the cell wall at the point of entry. After entering a cell of a susceptible plant the infection hypha developed into a simple haustorium with a vesicular distal portion, surrounded by a thick sheath with a conspicuous membrane. On highly resistant plants, the progress of the infection hypha was soon stopped by an antagonistic reaction of the host, the cytoplasm of which appeared to undergo some degree of disorganization around the point of infection, in some cases even before invasion of the cell was complete, terminating in the ultimate collapse of the infected cell. While in some plants the invaded cell alone became necrotic with no apparent injury to the adjacent cells, in others small brown necrotic areas were produced, involving a number of surrounding cells. Establishment of the fungus on moderately resistant plants was effected in much the same manner as on the highly susceptible, and a fairly congenial relationship appeared to be maintained with the host, growth on the surface of the plant being roughly in proportion to the degree of susceptibility of the latter. In one plant, however, necrotic spots appeared on the leaves about eight days after successful infection and

eventually killed them. It was observed that in both the susceptible and resistant plants the nucleus moved towards the fungus invading the cell.

JONES (F. R.) & WEIMER (J. L.). **Stagonospora leaf spot and root rot of forage legumes.**—*J. agric. Res.*, lvii, 11, pp. 791–812, 3 figs., 1938.

A species of *Stagonospora*, identified as *S. meliloti* [*R.A.M.*, xv, p. 632], previously known only as a leaf-spotting fungus of several fodder crops, was found causing an undescribed root rot of lucerne in California and Wisconsin. At Riverside the disease occurred only on the upper part of the tap-root and on the crown branches, the lesions being dark brown to black, smooth at first but becoming rough. The disease progresses slowly, and requires several months to rot a medium-sized lucerne root. No new buds are formed and the plant eventually dies. At Madison the lesions strongly resembled crown rot due to *Phytomonas insidiosa* [*Aplanobacter insidiosum*]. A root rot of sweet clover [*Melilotus*] was readily produced by inoculations with this fungus but only once observed in the field. The disease is not easily recognized macroscopically but the fungus could be identified microscopically by the application of Gram's stain, which shows up the mycelium in the roots and large stems, but not that in the leaves. The root rot developed best at high soil temperature while the leaf spot appeared abundantly at low temperatures in early spring and late autumn. The fungus, which appeared to be a wound parasite, was found to produce three fruiting forms, viz. *S. meliloti*, characterized by a peculiarly shaped rostrum to the pycnidium; *Phoma meliloti* developing in the autumn; and *Leptosphaeria pratensis* appearing on dead stems in the following spring. In culture *S. meliloti* varied very much with age and origin, the mean length of the pycnospores ranging from 13 to 18 μ, these differences being apparently unrelated to the host sources. Some of the isolations from the more important hosts will infect sweet clover roots, though in varying degree, and isolations from sweet clover vary greatly in pathogenicity towards that plant.

The taxonomy of the fungus is discussed in some detail and a list is given of 26 species proposed as synonyms of *S. meliloti* by various authors, including *Asochyta affinis*, *A. medicaginis*, *Marssonina medicaginis*, *Septogloeum medicaginis*, *Gloeosporium medicaginis*, and *Septoria trifolii* Cav. No synonyms of *P. meliloti* are given, but those of *L. pratensis* include *L. dumetorum* and its f. *meliloti*, *L. eustoma* f. *major*, and *L. meliloti*. For the closely related fungus *Phleospora trifolii* var. *recedens* on *Trifolium pratense* the name *Stagonospora recedens* (Massalongo) n. comb. is proposed.

STEVENS (N. E.). **Departures from ordinary methods in controlling plant diseases. Supplementary note.**—*Bot. Rev.* iv, 12, pp. 677–678, 1938.

In this supplementary note to his earlier paper on newly devised methods of plant disease control [*R.A.M.*, xviii, p. 125] the author cites, *inter alia*, a communication from R. C. Baines suggesting that collar rot of apple trees due to *Phytophthora cactorum* [ibid., xvii, pp. 254, 827] may be controlled by the use of resistant varieties to form the

roots and trunks and the grafting of Grimes on these stocks 30 in. or more above soil-level. Inoculation tests indicated that Northern Spy, Walbridge, Virginia Crab, Arkansas, and Hibernal are resistant and may be used as a stock for Grimes.

Cooley (J. S.) & Davidson (R. W.). **White root rot of Apple trees (Corticium galactinum).**—Abs. in *Phytopathology*, xxix, 1, p. 5, 1939.

Corticium galactinum, first observed as an agent of apple root rot in the United States by von Schrenk in 1902, seems to have been overlooked since that date in spite of its destructive character. Affected trees are rapidly killed, though the disease does not appear from the available evidence to be highly contagious. Trees inoculated with a monospore culture at transplanting developed 100 per cent. infection, whereas those similarly infected but left undisturbed in the nursery contracted only 50 per cent. A dense weft of mycelium covers the surface of the affected roots, the bark, cambium, and wood of which are subsequently penetrated and destroyed in irregular patches, appearing on removal of the cortex as light areas with dark, sometimes nodular or verrucose borders due to callus formation. Ultimately the entire root is killed. The hymenium of the fungus is white, later turning buff to ochraceous, and is formed in cavities in the soil surrounding the diseased root systems. *C. galactinum* has been found on dewberry, blackberry, Japanese wineberry [*Rubus phoenicolasius*], dogwood [*Cornus*], *Lychnis alba*, and sumac [*Rhus* (?) *copallina*] in the vicinity of infected apples.

McNew (G. L.). **Differential reaction of Apple varieties to Gymnosporangium juniperi-virginianae.**—*Res. Bull. Ia agric. Exp. Sta.* 245, pp. 117–142, 6 figs., 1938.

Collections of *Gymnosporangium juniperi-virginianae* [*R.A.M.* xvi, p. 618] from different localities in Iowa and seven other States were tested in Iowa in 1933 and 1935 on Bechtel's Crab and the following differential varieties of apples, listed in order of increasing resistance to the rust: Wealthy, Jonathan, Rome Beauty, York Imperial, Tolman, Ben Davis, Maiden Blush, Oldenburg (Duchess), Turley, Grimes Golden, Delicious, and Northwestern Greening. Most of the collections produced aecidia on Bechtel's Crab, Wealthy, Jonathan, and Rome Beauty; flecks with or without spermogonia on York Imperial, Tolman, Ben Davis, Maiden Blush, Oldenburg, Turley, and Grimes Golden; and flecks on Delicious and Northwestern Greening. On the basis of differential reactions of the varieties the collections could be classified into the following eight groups, the first four being considered potential parasitic races: (1) producing aecidia on Tolman and York Imperial; (2) causing a diffuse spreading fleck on York Imperial and defoliating Jonathan after large aecidial sori had been produced; (3) failing to infect Delicious and Northwestern Greening; (4) defoliating Turley after producing spermogonia; (5) failing to infect Northwestern Greening but causing typical flecks on Delicious; (6) producing a definite punctiform fleck on Ben Davis; (7) producing the same fleck on Ben Davis with spermogonia in most of the flecks; and (8) causing only a

few small, restricted yellow flecks on Turley. All collections studied, with the possible exception of group (3), penetrated the epidermis and became inter- or intracellular in the palisade layer. The hyphae from collections causing punctiform flecks on Ben Davis and Turley collapsed in the midst of injured cells of the palisade parenchyma. In group (2) the hyphae developed slightly further in York Imperial before collapsing in the cells of the spongy parenchyma. Collections producing spermogonia in the diffuse flecks on Ben Davis caused hypertrophy of cells in the spongy parenchyma, such cells collapsing in contact with the spermogonia before its maturation. The mesophyll cells underwent hypertrophy and hyperplasia before the formation of spermogonia in all varieties except Maiden Blush, in which the mycelium developed in the palisade layer and produced spermogonial initials, but cells of the spongy parenchyma appeared sensitive to the haustoria. The author postulates that the fungus must penetrate the spongy parenchyma cells without undue injury and stimulate them to grow before it can obtain sufficient food to develop further.

DUNEGAN (J. C.). **Germination experiments with overwintered teliospores of Tranzschelia pruni-spinosae.**—*Phytopathology*, xxix, 1, pp. 72–78, 1 fig., 1939.

Teleutospores of the *typica* variety of *Tranzschelia* [*Puccinia*] *pruni-spinosae* [*R.A.M.*, xvii, p. 756; xviii, p. 259], overwintered on fallen leaves of wild cherry (*Prunus serotina*) at the Arkansas Agricultural Experiment Station, germinated when tested on various dates between 11th February and 6th April, 1938. The same organs, scattered over the surface of water agar in Petri dishes, germinated profusely, producing short promycelia and forming basidia and spores, the last-named measuring 12·5 to 16 by 5·5 to 6·5 μ. In hanging drops of tap water germination was relatively scanty, the promycelia, basidia, and sterigmata frequently assumed abnormal shapes, and spore formation was at times suppressed. Under natural conditions basidiospore production probably occurs at irregular intervals following frequent saturating rains for a period of several months in the spring. Teleutospores of the *discolor* variety did not germinate in any of the experiments.

HUTCHINS (L. M.). **Apparent localization of phony disease virus in the woody cylinder.**—Abs. in *Phytopathology*, xxix, 1, p. 12, 1939.

Attempts at the transmission of phony disease of peach [*R.A.M.*, xvii, p. 125] from infected to healthy trees by means of patch-grafting gave uniformly negative results, but when whole sections of diseased roots, comprising both bark and wood, were grafted on the roots of normal trees, transmission was effected in every case in which growth union took place. The phony virus would thus appear to be localized in the woody cylinder, though direct proof of this hypothesis is not yet forthcoming. In this connexion it may be noted that the chemical laboratory test for phony disease [ibid., xiii, p. 38] gives a positive reaction only in the wood, the bark responding negatively. The inclusion of graft inoculum from both bark and wood in future experiments on suspected virus diseases of woody plants is recommended.

Hutchins (L. M.) & Rue (J. L.). **Promising results of heat treatments for inactivation of phony disease virus in dormant Peach nursery trees.**—Abs. in *Phytopathology*, xxix, 1, p. 12, 1939.

In January, 1937, two-year-old dormant nursery peach trees, inoculated a year previously with the phony virus [see preceding abstract], were completely immersed in hot water. All trees surviving an immersion of 40 minutes or longer at 48° C. made normal growth and were still completely healthy on 3rd October, 1938, when a negative reaction was given to a laboratory test for the disease. On the other hand, immersion for 35 minutes or less failed to inactivate the virus, as shown by the positive reaction to the test on the same date.

Wenzl (H.). **Fleckenbildungen, Nekrosen und Wachstumsstörungen an Aprikosenblättern.** [Spotting, necroses, and growth disturbances on Apricot leaves.]—*Z. PflKrankh.*, xlviii, 12, pp. 588–592, 3 figs., 1938.

The leaves of cultivated and wild apricots and myrobalan [*Prunus divaricata*] in various districts of Austria have been observed for some years past to show various pathological manifestations of obscure origin. Greenish-yellow spots, 3 to 4 mm. in diameter, with irregularly radiating margins, develop on the upper side, mostly along the larger veins; on cultivated varieties necrosis of the centres of the lesions frequently ensues. On the petioles the spots assume an elongated shape and a corky, rimose aspect. Some of the diseased leaves retain their normal shape, while others are stunted or distorted in various ways. Shoots bearing a large number of affected leaves may also present a truncated appearance. Young trees, especially stocks, are more liable to the disorder than older ones.

The Austrian apricot disease, though probably of virus origin (bacteria and fungi being definitely excluded), was shown by a comparative examination to be distinct from the mosaic of the same host occurring in Bulgaria and Czechoslovakia [*R.A.M.*, xiv, p. 642; xv, p. 376], as well as from that of apricot and other *Prunus* spp. in France [ibid., xv, p. 515]. It approximates closely in its symptoms to leaf curl of *Pelargonium* [ibid., xvii, p. 684], and should be designated as 'leaf curl', pending further investigations. A similar malady appears to occur in Bulgaria on wild apricots, besides the true mosaic.

Anderson (O. C.). **A cytological study of resistance of Viking Currant to infection by Cronartium ribicola.**—*Phytopathology*, xxix, 1, pp. 26–40, 2 figs., 1939.

A cytological examination of foliage of the blister rust-resistant Viking red currant from Norway inoculated with *Cronartium ribicola* [*R.A.M.*, xviii, p. 39] at the New York State College of Forestry disclosed the presence of a few hyphae in young, fully expanded but unhardened leaves, entry having been gained by the germ-tubes through the stomata. The hyphae died, however, before the fungus was able to develop a mycelium capable of producing uredo- or teleutospores. Fully matured, hardened leaves, on the other hand, with one exception showed

no evidence of infection, though stomatal penetration by the germ-tubes had actually taken place. The immature leaves reacted to the penetration and temporary invasion of the hyphae by the production of minute, necrotic lesions subsequent to the death and dispersal of the mycelium. The cytological changes in the protoplasm of the rust and host are described.

The resistance of Viking leaves to infection by *C. ribicola* appears to be of a physiological rather than a physical order, since the non-infected foliage of the Norwegian currant did not differ in gross anatomical characters from three susceptible species. These cytological data confirm the results of extensive laboratory and field tests demonstrating the extreme resistance of Viking to blister rust. The Norwegian variety may therefore safely be distributed as cuttings without risk of disseminating the disease among other currants or five-needled pines, and its desirable horticultural qualities fit it for use as a parent in the breeding of rust-resistant varieties.

BARTHELET (J.). **Recherches sur la mortalité des rameaux de Groseilliers.** [Studies on the dying-off of Currant twigs.]—*Ann. Épiphyt.*, N.S., iv, 3, pp. 495–512, 4 pl., 6 figs., 1938.

The cultivation of the black currant is stated to be seriously menaced in the Côte-d'Or Department of France by a disease of long standing, which every years kills off a number of the main branches and not infrequently results in the death of the whole bush. The trouble is more prevalent and spreads more rapidly among plants with a bushy habit than among black currants established on a single short stem, probably because of the more humid conditions at the crown of the former. The death of the twigs and small branches usually occurs very suddenly in the early spring, but may also take place throughout the year; occasionally an affected branch may put out feeble shoots which die gradually. During the winter diseased branches may be recognized by the slightly discoloured and slightly depressed cortex at their base. On decortication diseased wood exhibits a slate-grey discoloration extending from the base of the branch to over 10 to 15 cm., and usually starting from a pruning wound. The fungus constantly isolated from diseased material collected locally and in the experimental fields at Versailles was described in 1930 by Arnaud and the author as belonging to the genus *Phomopsis*, and was shown by further studies in pure culture to be identical with *Cytosporina ribis*, correctly renamed *P. ribis* by Grove [*R.A.M.*, iii, p. 433]; it is further believed that *Libertella ribis*, described from England by A. L. Smith, may also eventually prove to be identical with this species. In more recent years the perfect stage of the fungus was found by the author on red currant canes, on black currant twigs, and on gooseberry bushes growing in close proximity to infected black currants; the fructifications were distinctly of the *Eutypa* type, and further studies showed that morphologically the fungus may be referred to *E. lata*, in spite of some minor differences, which the author considers sufficient to constitute it a variety, *ribis*, of this species. The globose perithecia with a fairly short beak and a conical, obtuse ostiole, measuring 300 μ in diameter, are produced in stromata on the cortex, and separately inside the wood of denuded

branches; they contain numerous asci, 110 to 190 μ long, with long pedicels, the sporiferous portion being only about 40 μ in length; the asci contain 8 allantoid spores measuring 8 to 9 by 2 μ.

Notes are given on other fungi which, in the course of the investigations, were also found on species of *Ribes*, including *Nectria cinnabarina*, *Plowrightia ribesia*, *Botryosphaeria ribis*, *Botrytis cinerea*, *Diaporthe pungens*, apparently causing small cankers on red currant branches, and *Phragmodothella kelseyi* differing from *Plowrightia ribesia* in having triseptate spores. Two species occurring on dead *R. rubrum* twigs are described as new to science and named *Diatrype ribis* and *Botryodiplodia ribis*.

Shaw (H.). **The problem of spray residues on orchard fruit.**—*J. Soc. chem. Ind., Lond.*, lviii, 4, pp. 65–66, 1939.

In experiments at the East Malling Research Station on the joint control of the raspberry beetle (*Byturus tomentosus*) and the cane spot fungus (*Elsinoe veneta*) [*R.A.M.*, xvii, p. 447] on soft fruits of the raspberry-loganberry group, the use of the highly efficient Bordeaux mixture had to be abandoned on account of the complete disfigurement of the berries by the residue. The slight film of deposit left on the fruits by lime-sulphur was not considered important, but reports from canners drew attention to the deleterious action on the tins of berries carrying a residue of this type. A convenient substitute for use with the derris wash was found in copper oxychloride, which gave satisfactory disease control without leaving any appreciable traces on the fruit. Dusting strawberries with sulphur for the combined control of mildew (*Sphaerotheca humuli*) [ibid., xvi, p. 762; xviii, p. 191] and red spider (*Tetranychus telarius*) has to be discontinued for an appropriate period before picking in order to avoid the accumulation of an undesirable residue.

Grigsby (B. H.). **Physiological investigations of Red Raspberry plants inoculated with Red Raspberry mosaic.**—*Tech. Bull. Mich. agric. Exp. Sta.* 160, 27 pp., 4 figs, 1938.

A comparative study of the physiological activities of raspberry plants infected with mosaic and masked mosaic [*R.A.M.*, xviii, p. 190] and healthy plants of the Latham variety was carried out in Michigan. An analysis of the leaves showed a decrease in simple sugars and starches in the mosaic and masked mosaic plants and an increase of sucrose in the former. Mosaic and masked mosaic plants contained smaller amounts of total nitrogen and nitrate nitrogen but larger amounts of ammonia than healthy plants. Diastatic activity appeared to be greater in mosaic than in healthy or masked mosaic plants. Taking the photosynthetic activity of healthy plants as 100, the figures for mosaic-diseased plants were 64, 87, and 54 in three tests and those for respiration 100, 121, 134, and 142, respectively; the figures for masked mosaic in one test were 103 for photosynthesis and 114 for respiration compared with 100 for healthy plants in each case. The transpiration rate was found to be higher in mosaic plants (138) than in healthy ones (100) while that of masked mosaic plants (121) was intermediate. Stomatal counts showed that while there were 9·4 to 9·8

stomata per sq. mm. of leaf area on old and 15·0 to 15·5 on young healthy leaves, there were 25·5 to 31·6 stomata on old and 40·5 to 41·7 on young mosaic leaves. The chlorophyll content was 3·08, 2·97, and 2·61 mg. per 100 sq. cm. of leaf area for mosaic, masked mosaic, and healthy plants, respectively. Leaf ash analyses made by the spectrographic method showed that the afternoon figures for silicon and ash were generally lower than those of the morning, indicating a possible diurnal variation in salt content. The content of potassium was slightly higher in mosaic than in healthy plants and that of calcium lower.

WELLINGTON (R.). **The Strawberry problem.**—*J. Minist. Agric.*, xlv, 10, pp. 1008–1018, 1939.

Discussing the problem of virus disease in relation to strawberry-growing in England, the author points out that of the three distinct strawberry viruses present, yellow edge [*R.A.M.*, xvi, p. 762] and severe crinkle [ibid., xvii, p. 828] lead to the complete destruction of the plants, while mild crinkle [loc. cit.] appears to be of small economic importance. In theory, the normal yield of fruit should amount to 2 tons per acre, but actually 3 to 4 tons per acre are not infrequently obtained from virus-free plantings, though in those where virus disease is present the usual figure is 15 to 25 cwt. per acre.

The strawberry varieties at present grown fall into two groups, the Virginiana or British group (Royal Sovereign, Duke, Laxton, Sir Joseph Paxton, and Stirling Castle) and the Chiloensis or Continental (Madame Lefebvre, Madame Kooi, Oberschlesien, Tardive de Léopold, Brenda Gautrey, and Western Queen). The former varieties show much less resistance to virus attack than the latter, and are quickly destroyed, whereas the latter seldom, if ever, show symptoms even when the plants are heavily infected. Entirely virus-free plants are found only in the Royal Sovereign variety, though apparently perfectly clean Sir Joseph Paxton plants are now being tested.

The writer's personal experience as a grower has shown conclusively that heavy crops are obtainable if proper precautions are taken. Growers must confine themselves to the Royal Sovereign variety. Hybridists should concentrate on raising new virus-free varieties of the Virginiana group and cease to raise new varieties from the dangerous Continental group. A special bed must be made for runner production, planted with stock known to be virus-free, and situated at least half a mile away from all other strawberries. The runners must be planted on land not planted previously to strawberries, and each annual planting must be kept in a field not previously used for strawberries. Runners of this quality cost 40*s*. or 50*s*. per 1,000 but give an increased return of £80 to £150 per acre each year for two or three years. New fruiting plantations must also be as isolated as possible from older beds and other growers' beds, and before the new plantations are made, all heavily infected, older fruiting beds should be ploughed up. The life of the new plantations will be at most three years in the areas of concentrated strawberry-growing, and up to seven years if the plantations are isolated; probably, however, it would be advisable to plough up all fruiting beds after three crops.

Magee (C. J.), Eastwood (H. W.), & Foster (E. P.). **Control of squirter and black end diseases of Bananas. Success of the case dip.**—*Agric. Gaz. N.S.W.*, l, 1, pp. 22–24, 2 figs., 1939.

In a series of experiments carried out in New South Wales on the control of banana squirter disease (*Nigrospora sphaerica*) and black end (due mainly to *Gloeosporium musarum* and *Fusarium* spp.) [*R.A.M.*, xvi, p. 763], cases of fruit selected from plantations where these diseases were prevalent were dipped in shirlan AG at a concentration of 1 per cent., after being packed for market in the usual way. The fruit was than kept in Murwillumbah for four days, sent by train to Sydney, and there ripened by standard methods. The delay before dispatching was intended to correspond with the period usually required to reach distant markets. One week after ripening counts were made for squirter, and the prevalence of black end was estimated by inspection of one-half of each case as displayed to buyers. The result showed that squirter was completely controlled and black end virtually eliminated. In other tests, delay in dipping until 24 hours after packing did not reduce control, and the use of the dip at half strength satisfactorily controlled both diseases. It is recommended that bananas on dispatch to market during winter and spring should be given a routine dip in shirlan AG (0·5 per cent.). The dip should be freshly made each packing day.

Wardlaw (C. W.). **Banana diseases. XII. Diseases of the Banana in Haiti, with special reference to a condition described as 'plant failure'.**—*Trop. Agriculture, Trin.*, xv, 12, pp. 276–282, 1938.

In all parts of Haiti, Gros Michel banana plantations after five or ten months, or in the second or third year, develop leaf failure. In plants five to ten months old, the lower leaves may prematurely assume a yellow, yellow-brown, or dirty yellow and streaked appearance, and show spotting by secondary fungi. Later they turn brown or dark brown. Older plants develop yellow and discoloured, greenish-yellow, brown and fallen leaves prematurely in acropetal succession. In the second or third year, the leaves of affected adult plants appear short and narrow, and form an erect cluster round the 'throat' of the plant. A black mark is present where the petiole of the affected leaves meets the trunk, which gradually becomes pale yellow or pallid green. When the bunches are 'shot', they are found to be short-fingered, often with the top hand widely separated from the bottom hand. Occasionally, the plants are reduced in stature. This plant failure is attributed to a high rate of evaporation from the leaves, and the presence of some soil factor causing premature death of the rootlets, probably a high alkali content and inadequate supplies of essential minerals. Pronounced alkali chlorosis, probably a more advanced form of the same condition, also occurs in which the leaves, stems, and bunches may present all stages of chlorophyll deficiency.

A survey made in September and October, 1938, indicated that sigatoka disease (*Cercospora musae*) [*R.A.M.*, xviii, p. 264] was not fully epidemic in Haiti, but may be expected within 6 to 12 months seriously to affect fruit quality in some localities.

Panama disease (*Fusarium oxysporum cubense*) [ibid., xvii, p. 730]

was observed on Gros Michel bananas in the Artibonite area, the causal organism being isolated and cultured. The diseased stools are being destroyed with heavy gas oil. Owing to neglect and floods, infection is likely to cause heavy losses in the vicinity of Jacmel.

Moko disease (*Bacterium solanacearum*) [ibid., xvii, p. 760] was observed on moko plantains and Gros Michel bananas, but appears to be much less virulent in Haiti than elsewhere.

Stem rot (*Marasmius semiustus*) [*M. stenophyllus*: ibid., xv, pp. 451, 778] was present in the Cap Haitien area, where flooding had been succeeded by very dry conditions. Cigar end (*Stachylidium theobromae*) [ibid., xvii, pp. 50, 589] occurred occasionally on Gros Michel, affecting one to three fruits per bunch. Sun scald was present on some plantations, and at certain seasons irregularly developed bunches with twisted fingers and general lack of symmetry ('May' bunches) were frequently noted. Large dark spots and extensive pale spots or marginal blotches, resembling those attributed to *Helminthosporium torulosum* and *Cordana* [*Scolecotrichum*] *musae* [ibid., xvii, p. 331] were commonly present. The speckle attributed to *Chloridium musae* [ibid., xvii, p. 191] was noted in damp localities.

Gros Michel bananas were affected by the virus heart rot recently reported from Guadeloupe [loc. cit.]. In addition to striping and mottling of the younger leaves, dark purple and blue streaks appeared on the older ones, and small, water-soaked, later yellowish, and finally blood-red pockets were present along the whole length of the trunk, which had a bluish appearance, in the outer and inner leaf sheaths, and ultimately in the bulb. It is recommended that all infected stools should be destroyed and the disease made subject to official supervision.

Green-red bananas were affected by a virus disease of a type well known in the West Indies, characterized by streaky leaf mottle, but without any heart rot.

BARNETT (W. L.) & WARD (F. S.). **Leaf spot disease of Bananas.**—*J. Jamaica agric. Soc.*, xlii, 11–12, pp. 555, 557, 1938.

In further tests carried out in Jamaica for the control of banana leaf spot [*Cercospora musae*: *R.A.M.*, xvii, p. 473] plots fertilized as well as dusted showed greater improvement than plots dusted only, while many plots fertilized but not dusted showed the same rate of improvement as those fertilized and dusted. Most of the plots were in a locality where the disease is present in a mild form.

Prolonged drought in the early part of 1938 was unfavourable to infection but also reduced the vigour of the plants, with the result that their susceptibility was increased when the next wet season set in. The plots in the coastal regions generally show marked resistance, especially those on sloping, well-drained, limestone soils. The demonstration plots in the hilly areas have given the most unsatisfactory results, largely owing to the cooler and wetter weather that prevails here. This favours the fungus and also makes satisfactory dusting difficult, though portable hand pump barrel sprayers are giving promising results.

It is concluded that frequency of spraying or dusting can safely be reduced, provided the ground is properly manured. Dusting at fort-

nightly intervals was not appreciably more effective than dusting at intervals of three weeks. Greater attention should be paid to improving the soil drainage and aeration, undrained areas showing a higher incidence of infection than drained ones. Noticeable improvement has followed dust treatment in cases of light infection, and where this has occurred the treatment should be continued. In badly affected areas (where dust treatment is uneconomic), all the plants should be cut down, and replanting carried out only after fertilizers have been ploughed in or added after forking.

STERN (J.). **Nuevos aspectos del problema del chamusco del Plátano en México.** [New aspects of the problem of scorch of the Plantain in Mexico.]—*An. Esc. nac. Cienc. biol., Mexico*, i, 1, pp. 161–167, 2 graphs, 1938.

The writer briefly discusses the climatic factors influencing the development of scorch [leaf spot] of plantain leaves (*Cercospora musae*) [see preceding abstracts] and summarizes the present situation in Mexico [*R.A.M.*, xviii, p. 192] and elsewhere in Central and South America in respect of the control measures initiated by the United Fruit Company. Stationary spray plants have been installed in Honduras and Guatemala, where treatments with 5–5–50 Bordeaux mixture are applied at 15- to 30-day intervals; dusting from aeroplanes with a mixture of monohydrated copper sulphate and lime (20–80) at the rate of 100 kg. per hect. is also carried out in the latter country, but has been abandoned as too costly in the former. The stationary system is considered to be beyond the economic scope of the Mexican plantain industry, and dusting is effected by means of motor-driven appliances. Both in Colombia and Haiti [see above, p. 327] a combined spray-dust schedule has been adopted. As regards Mexico, further consideration of the control problem is regarded as urgently necessary. As in Colombia and Haiti, there are two well-defined climatic zones in Mexico, namely, one of heavy precipitation, where it is thought fungicidal applications will be necessary throughout the year—at 20-day intervals during the rainy season and proportionately less often in comparatively dry periods—and a region of lower rainfall, e.g., Chiapa, in which the treatments need only be given shortly before and during the rains.

DAS GUPTA (S. N.) & VERMA (G. S.). **Studies in the diseases of Mangifera indica Linn. I. Preliminary observations on the necrosis of the Mango fruit with special reference to the external symptoms of the disease.**—*Proc. Indian Acad. Sci.*, Sect. B, ix, 1, pp. 13–28, 1 col. pl., 1939.

In this paper the authors give a detailed account of necrosis (or black tip) of mango fruits first recorded in Bihar in 1908 and in the United Provinces in 1923, and probably occurring in other localities. The first outward symptom is the development of a small, etiolated area at the distal end of the fruit, which gradually spreads until it covers the whole tip. As a rule, before etiolation is complete, isolated, greyish, indefinite spots appear, the tip turning a dirty green. The spots then become dark brown, enlarge, and coalesce into a continuous necrotic area. The tissues decay and the necrotic portion collapses. The pericarp and

mesocarp disintegrate, exposing the dark brown flesh, beyond which the stone protrudes, with a layer of collapsed tissue over it. Gummosis is frequently present. Marked differences were noted in varietal susceptibility, Dasehri mangoes showing 100 per cent. infection in the orchards studied, while Safeda (Narma) and Tambaria appeared to be immune.

No fungus or bacterium was isolated from affected material, and no definite evidence was obtained of any virus origin of the condition. Locally, the necrosis is attributed to the fumes from brick-kilns [*R.A.M.*, xvii, p. 259], but as it is not present in all orchards exposed to such fumes some other factors must be at least partly responsible. Lack of vigour in the trees appeared to be a contributory factor.

A condition referred to as 'taper tip' is characterized by an intensification of the normal green colour at the distal end of mangoes. The affected portion takes little or no part in the development of the fruit, with the result that in mature fruits the distal end tapers off suddenly and is frequently curved. Affected fruits fail to reach normal size and are readily detached from the stalk. Both the necrosis and taper tip may be present on the same fruit.

KINMAN (C. F.). **Olive growing in the southwestern United States.**—*Fmrs' Bull. U.S. Dep. Agric.* 1249, 32 pp., 20 figs., 2 maps, 1938.

This bulletin (a revised version of one originally published in 1922) contains brief notes (pp. 31–32) on three diseases affecting the olive crop of California and Arizona, namely knot (*Bacterium* [*Pseudomonas*] *savastanoi*) [*R.A.M.*, xviii, p. 262], dry rot [regarded as a physiological disease by W. T. Horne et al.: ibid., iii, p. 323], and soft rot. The Manzanillo variety is the chief sufferer from knot, to which Ascolano, Sevillano, and other large-fruited varieties are resistant, and Mission almost immune. On the other hand, the large-fruited olives are very liable to soft rot, which prevents their use for processing. The shrivelling and browning due to dry rot are also troublesome in connexion with pickling, since lye is more readily absorbed by the diseased than by the surrounding healthy tissues.

CRISTINZIO (M.). **Una malattia del Pistacchio (Pistacia vera L.) causata da una Botryodiplodia.** [A disease of Pistachio (*Pistacia vera* L.) caused by a *Botryodiplodia*.]—*Ric. Ossvz. Divulg. fitopat. Campania ed Mezzogiorno* (*Portici*), vii, pp. 42–56, 1 pl., 1 fig., 1 graph, 1938.

Wilted two- to three-year old branches of *Pistacia vera* trees in Sicily showed dry, ashy-coloured, isolated or confluent, subelliptical sunken areas bearing circular or oval pustules (mostly in groups), $\frac{1}{2}$ to $1\frac{1}{2}$ mm. in diameter. The diseased bark showed small, longitudinal splits, which emitted a pale yellow resin, and the edges of the lesions showed cicatrice formation. In some instances, the lesions completely encircled the branch.

Below the pustules on the diseased parts were borne subspherical, slightly depressed, generally erumpent pycnidia, 600 to 1,200 μ in diameter, and 300 to 400 μ high, usually incompletely divided by hyaline or subhyaline septa. The hyaline, simple conidiophores measured

14 to 25 by 3 to 5 μ, while the ovoid or ellipsoid, elongated, straight or slightly falcate, hyaline, later olivaceous-brown conidia were rounded at the extremity, showed a clearly visible epispore, and measured 34 to 50 by 16 to 24 μ. The fungus is named [with a Latin diagnosis] *Botryodiplodia pistaciae* n. sp. The minimum, maximum, and optimum temperatures for germination were, respectively, 7°, 36°, and 22° C.

Inoculations of young branches of *P. terebinthus* by inserting fragments of a culture of the fungus in deep incisions made in the bark gave positive results in 25 days, by which time the fungus had progressed 12 cm. from the inoculation site; in 36 days the inoculated trees showed symptoms identical with those of natural infections.

The control measures recommended consist in removing and burning the withered branches, disinfecting the pruning wounds, and spraying immediately after leaf fall and again a fortnight before the buds open with Bordeaux mixture (4 per cent.) or alkaline polysulphides; in addition, applications of Bordeaux mixture (1 per cent.) should be made in spring, and after hailstorms or sudden drops in temperature.

Reid (W. D.). **Grease spot of Passion Fruit.**—*N.Z.J. Sci. Tech.*, A, xx, 4, pp. 260–265, 5 figs., 1938.

Considerable losses have been caused in various parts of North Island, New Zealand, during the past four years by grease spot of passion fruit (*Passiflora edulis*) due to *Phytomonas passiflorae* n. sp. [*R.A.M.*, xviii, p. 235], which produces on the fruits sharply defined, roughly circular, greasy patches; on the leaves brown lesions 0·5 to 15 mm. in diameter, those exceeding 2 mm. being surrounded by a pale yellow halo 4 to 6 mm. in width; on the young stems water-soaked, light brown, depressed areas, 10 by 5 mm., bordered by irregular swellings; and on the older wood lesions of various types, viz., circular, smooth, dark green, and depressed, 5 mm. in diameter, or dark brown, dull, and minutely fissured, 300 by 20 mm. The cortex is dry and spongy, often longitudinally split, and readily lifted from the underlying wood. Internally it is light brown, interspersed with small, dark brown streaks. The causal organism is irregularly distributed through the parenchyma. Various fungi, such as *Fusarium* and *Cladosporium* spp. and *Glomerella cingulata*, occur as saprophytes in old lesions. The disease is of great economic importance, reducing the market value of the fruit through disfiguring blemishes and in the garden causing defoliation, fruit drop, and death of the vines.

P. passiflorae makes good growth on standard laboratory media, e.g., beef peptone agar, at 21° to 27° C., developing singly or in pairs as capsulate, Gram-negative rods measuring 1·2 to 3·2 by 0·2 to 0·5 (average 1·5 by 0·45) μ or 2 to 4·3 by 0·25 to 0·5 μ, respectively; the organism is motile by one to five polar flagella; it forms flat, dry, shining, smooth, butyrous, translucent, greyish colonies; liquefies gelatine stabs; clouds nutrient and tryptophane broth; alkalizes but does not coagulate litmus milk; turns potato slices grey, dark buff, and finally dark brown at the top and light grey at the base; does not reduce nitrates, form indol or hydrogen sulphide, or hydrolyse starch; does not evolve gas from lactose, sucrose, glucose, galactose, raffinose, mannitol,

or starch; alkalizes lactose, raffinose, and glucose in twelve days; and acidifies galactose, starch, and sucrose.

The disease appears to be spread in the field by workers during handling operations and to persist from one season to the next in the infected tissues. Control should consist in the pruning out of dead material and thinning healthy vines to half a dozen leaders, to be trained over wires so as to facilitate penetration by monthly applications of 3–4–50 Bordeaux mixture. Prunings and fallen leaves and fruits should be burnt or buried, and heavily infected vines destroyed.

Specialpræparater til Bekæmpelse af Plantesygdomme og Skadedyr anerkendte af Statens Forsøgsvirksomhed. Gyldig for Aaret 1939. [Special preparations for the control of plant diseases and pests recognized by the State Experiment Service. Valid for the year 1939.]—*Tidsskr. Planteavl*, xliii, 4, pp. 683–690, 1938.

A number of proprietary plant protectives, officially tested and approved by the Danish State Experiment Service, are enumerated with the appropriate concentrations for use against various well-known diseases and pests.

HORSFALL (J. G.). **Combating damping-off.**—*Bull. N.Y. St. agric. Exp. Sta.* 683, 46 pp., 7 figs., 2 graphs, 1938.

Based on nine years' experimental work at the New York State Agricultural Experiment Station, this bulletin presents a useful summary of information on the nature and control of damping-off, caused locally chiefly by *Pythium ultimum* and occasionally by *Rhizoctonia* [*Corticium*] *solani*, *Botrytis cinerea*, *Phytophthora* sp., and other fungi on a wide range of host plants. The protective value of seed treatments is stated to vary with the inoculum potential, defined essentially as the disease-producing power of the soil [*R.A.M.*, xii, p. 122]. As the inoculum potential increases, the protective value of the fungicide (red copper oxide in the author's experiments) declines, but not significantly until the inoculum potential reaches about 80 per cent. of the maximum, above which point it falls rapidly. About 0·5 mg. of metallic copper (as red copper oxide) per sq. cm. of seed surface is regarded as the minimum dosage. Seed disinfection with mercury, zinc, and copper, especially red copper oxide, is recommended as a protective measure, and in the case of seed-borne fungi, occasionally causing damping-off, such as *Gibberella saubinetii* on maize and other cereals, *Alternaria solani* on tomato, and others, it will practically eliminate the disease. A satisfactory treatment for small quantities of soil is a five minutes' immersion of soil-containers in boiling water. The new methods of working formaldehyde dust ($1\frac{1}{2}$ oz. per sq. ft.) into the soil or sprinkling it with $\frac{1}{2}$ tablespoonful in a little water to each sq. ft. are stated to be rapidly gaining ground. Flushing sand with water at 160° F. until clean prior to planting the seedlings and watering with a weak solution of saltpetre ($\frac{1}{2}$ tablespoon per sq. ft.) is described as a promising technique. The zinc oxide treatment for the surface of the soil ($\frac{1}{2}$ oz. per sq. ft.) [ibid., xiii, p. 388], used in addition to seed disinfection, gives prolonged protection owing to its persistence, but its use is limited to certain soils where zinc is not injurious. The red copper

oxide spray (1 oz. to 3 gals. for seedlings) has tended to supplant the zinc oxide soil treatment. It must be used in addition to a seed protectant, is simple, cheap, and non-injurious to almost all plants except the cabbage family, and should be applied heavily, taking care that it runs down the stem into the soil. The dribbling of 1 in 100 formalin or 1 per cent. copper sulphate on to the seed at sowing produced striking differences in the stands of spinach and peas, and mercuric chloride (1 oz. to 10 gals.) applied in the same way gave good control of damping-off of cabbage.

MERRILL (R. M.). **The use of vapor spray in plant disease control.**—*Agric. Engng, St Joseph, Mich.*, xix, 12, p. 524, 1938.

Particulars are given of further developments in the writer's technique for the utilization of water vapour as a carrier for various plant protectives at the Ohio Agricultural Experiment Station [*R.A.M.*, xvi, p. 696]. Several changes were necessary to adapt the apparatus used in the preliminary tests to spraying on an agricultural scale, and details are given of the modified construction. To carry the hot vapour from the generator to the plants a $\frac{1}{2}$-in. steam hose is used, during the passage through which the spray materials injected into the vapour line mix with the vapour and are released in a finely divided form at the nozzles. Mention is made, however, of certain disadvantages of the new equipment, including its relatively complicated construction, cumbersome method of operation, restricted utility in the case of tall trees in windy weather, and the adverse effect of heat on certain spray materials, though in the case of sulphur the heat induces a change from the crystalline to the amorphous state, thereby improving its adhesive properties.

McLACHLAN (T.). **The decay of building materials with special reference to microbiological agencies.**—*Proc. Food Group, Soc. chem. Ind.*, i, pp. 48–71, 1938.

In this paper the author discusses in detail the reasons supporting his view that the exposed portions of a building constitute a soil, and that their decay is to a large extent a matter of soil microbiology. Chemical analysis showed considerable difference between the so-called sooty deposit on buildings and real soot, the black material of the former being organic in nature. More decay occurs in buildings in towns than in those situated in country districts because the growth of micro-organisms is encouraged by the larger amount of food material carried in the atmosphere of towns than is the case in the country, where ultra-violet light is also greater. Evidence is presented that moulds penetrate into the interior of stone through the pores and not only carry and liberate acid but also introduce bacteria [*R.A.M.*, xii, p. 645] and water. The first product of decomposition in building material is calcium carbonate, and not calcium sulphate as is commonly believed. The larger amount of sulphated material in decayed town (as compared with decayed country) buildings results from the heavy fertilization of the building materials in towns with sulphur and sulphur compounds. A sulphate skin acts as a protective covering on a building, as it prevents a ready absorption of water and foods for micro-organisms. The

sulphate in decayed building material is secondary to the main causes of decay, the micro-organisms causing which are carried in the air and in rain water. Fungi isolated from building materials and rain water from eleven different localities in Great Britain and abroad comprised 47 species belonging to 26 genera, including *Aspergillus* (6), *Cladosporium* (3), and *Penicillium* (13). Evidence was obtained that fungi can be grown in limestones, and that they can attack calcium carbonate and redeposit calcium salts in an oolitic form in the presence of colloidal material.

Hildebrand (E. M.). **Techniques for the isolation of single micro-organisms.**—*Bot. Rev.*, iv, 12, pp. 627–664, 1938.

After an introductory discussion of the pure culture concept, the author reviews a large number of techniques for the isolation of single micro-organisms by dilution, semi-mechanical, and mechanical methods, and concludes with a detailed description of the modified Barber method of using the Chambers micro-manipulator. A bibliography of 149 titles is appended.

Van der Werff (A.). **A new parasitic organism in Zostera marina.**—*Chron. bot.*, iv, 6, pp. 498–499, 1938.

In the spring and summer of 1932 the author observed an organism on diseased eel grass (*Zostera marina*) in Holland [*R.A.M.*, xiii, p. 46], which he considers to be identical with the one found in North America and referred by Renn to *Labyrinthula* [ibid., xiv, p. 599; xv, p. 453; xvii, p. 543.]

Tutin (T. G.). **The autecology of Zostera marina in relation to its wasting disease.**—*New Phytol.*, xxxvii, 1, pp. 50–71, 2 pl., 2 figs., 1938.

Following a discussion on the taxonomy of *Zostera* and associated marine angiosperms, the habitat factors of importance in the life of *Z. marina*, the autecology of this species and (more briefly) of *Z. hornemanniana*, the author describes the occurrence and symptoms of the wasting disease of *Z. marina* and sums up the evidence for its causation by (*a*) a bacterium, (*b*) *Ophiobolus halimus*, (*c*) a species of *Labyrinthula* [see preceding abstract], and (*d*) the discharge of waste oil from shipping. None of these theories is acceptable to the author, who attributes the phenomenon to the sunshine deficiency of 20 per cent. in the British Isles in 1931–2, a figure stated to be unequalled in any other of the past ten years. Recovery, being dependent on the regeneration of the plant from seed, is likely to be a slow process.

Atkins (W. R. G.). **The disappearance of Zostera marina.**—*J. mar. biol. Ass. U.K.*, xxiii, 1, pp. 207–210, 1938.

The author states that T. G. Tutin's hypothesis [see preceding abstract] for the disappearance of *Zostera marina* from British waters is not supported by a study of the relevant meteorological data, which show, *inter alia*, that the mean sunshine values for 1931–2 are not outstandingly low. According to Dr. E. J. Allen of Plymouth, a scarcity of eel grass comparable to that now prevailing has not been observed within his 42 years' experience. A decrease in illumination, involving

a weakening in the constitution of the plant, is therefore quite an untenable theory of its disappearance.

SCHAEDE (R.). **Die Actinomyceten-Symbiose von Myrica gale.** [The Actinomycete symbiosis of *Myrica gale*.]—*Planta*, xxix, 1, pp. 32–46, 18 figs., 1938.

A detailed account is given of the writer's studies on the *Actinomyces* growing in the root nodules of *Myrica gale* on moorland soil on the Ostfriesland-Oldenburg boundary, Germany. The organism belongs to the group of symbionts already represented in association with alder [ibid., xvii, p. 568], *Hippophaë* [*rhamnoides*], and *Eleagnus* [ibid., xiii, p. 590]. On the basis of his observations the author differentiates two groups of *Actinomyces* root nodule symbionts, one in which the host assumes complete control over the endophyte and finally consumes it altogether, and another in which the intruder is permitted a certain degree of latitude culminating in the formation of bacteroids.

KOSER (S. A.) & SAUNDERS (F.). **Accessory growth factors for bacteria and related micro-organisms.**—*Bact. Rev.*, ii, 2, pp. 99–160, 1938.

This is a comprehensive review and critical discussion of the literature relating to the influence of accessory growth factors on the development of bacteria and related micro-organisms, including a number of fungi of different groups [*R.A.M.*, xvii, p. 409 and next abstract]. A bibliography of 179 titles is appended.

FRIES (N.). **Über die Bedeutung von Wuchsstoffen für das Wachstum verschiedener Pilze.** [On the importance of growth substances for the growth of various fungi.]—*Symb. bot. upsaliens.*, iii, 2, iv+188 pp., 25 graphs, 1938. [English summary.]

Following a concise survey of the literature relating to growth substances since 1901, the writer describes a series of experiments to determine the influence of various strains of lignicolous bacteria on the development of eleven wood-destroying Polyporaceae, viz., *Fomes pinicola* [*R.A.M.*, xviii, p. 4], *Lenzites sepiaria*, *Polyporus* [*Polystictus*] *abietinus* [ibid., xviii, p. 284], *Polyporus adustus* [ibid., xviii, p. 215], *P. amorphus*, *P.* [*F.*] *annosus*, *P. benzoinus* [loc. cit.], *Trametes cinnabarina* [ibid., xiii, p. 532], *T. serialis* [ibid., xviii, p. 285], *P.* [*F.*] *fomentarius* [ibid., xviii, p. 280], and *Daedalea unicolor*. Synthetic nutrient (glucose-containing) solutions were developed enabling the bacteria and fungi to be cultured simultaneously on the same substratum.

A supply of 4 per cent. Seitz-filtered bacterial culture permitted the utilization of a nutrient solution of this type by *P. adustus* and *Polystictus abietinus* until the nutrients were exhausted. The development of the two fungi under observation was markedly stimulated by the addition to the nutrient solution of bacteria at the relatively low rate of 10,000,000 per c.c., whereas in peptone-containing media a more or less pronounced inhibition of growth was induced by high bacterial concentrations (1,000,000,000 per c.c.). This suppression was found to be due to the production by the bacteria of certain thermolabile substances counteracting the normal stimulatory effect of the auxin. In many instances the growth of the Polyporaceae on solid agar was similarly increased by the incorporation with the medium of 4 per cent. of

a sterile bacterial culture. None of the experimental fungi made appreciable growth in pure synthetic solutions, and in extensive tests with *Polyporus adustus* and *Polystictus abietinus*, using various sources of carbon and nitrogen, with the addition of copper, zinc, or manganese, no development took place. The growth occurring on the introduction into the synthetic media of 1·5 per cent. agar was shown to be induced by the presence of growth substances in the latter. The results of these tests are considered to justify the conclusion that at any rate some of the Polyporaceae under investigation are unable to assimilate synthetic solutions devoid of auxins.

The bacterial growth substances were found to be thermostable, capable of passage through a Seitz filter, insoluble in ether, and readily soluble in 88 (but not in 96) per cent. ethyl alcohol.

In a series of experiments to determine the influence of aneurin (vitamin B_1), biotin [ibid., xviii, p. 232], and inositol on fungal growth, only the first-named (used mostly at the rate 10 mγ per flask) afforded a powerful stimulus to the process, far exceeding that of the most active bacterial extracts. An absolute demand for aneurin (implying virtual failure of growth in its absence) was expressed by *Polyporus adustus*, *Polystictus abietinus*, *T. serialis*, *L. sepiaria*, *D. unicolor* (under certain conditions), *Valsa pini* [ibid., xv, p. 408] (which, together with *Lophodermium pinastri* [ibid., xvii, pp. 196, 214, 567] and *Melanconium betulinum*, also required biotin), and *Phytophthora cactorum* [ibid., xviii, p. 129]. Fungi with only a relative demand for aneurin (i.e., making slow growth without it) included *Nectria coccinea* [ibid., xviii, p. 280], *V. ceratophora* [*V. ceratosperma*: ibid., xvi, p. 562], and *Sclerotinia cinerea* [*S. laxa*], while the accessory element failed to improve the naturally abundant development on synthetic media of *Aspergillus niger*, *Fusarium conglutinans* var. *callistephi* [ibid., xviii, pp. 113, 234], and *Hypochnus* [*Corticium*] *solani*. A noticeable effect was exerted by aneurin and biotin on the fungi responding to their presence, e.g., *Polyporus adustus* and *Nematospora gossypii*, respectively (the latter also requiring inositol [ibid., xvii, p. 196]), even at concentrations as low as 1 in 250,000,000,000.

The efficiency of aneurin as a stimulant to fungal development was further demonstrated by means of growth curves expressing the quantity of mycelium obtainable per weight unit of aneurin added to the substratum in suboptimal concentrations. This value, designated the mycelium/aneurin quotient, was generally found to lie between 500,000 and 2,500,000.

On the basis of the comprehensive discussion of the experimental data herein presented, the influence of the growth substances is interpreted as a compensation for the partial or total inability of the fungi concerned to synthesize them unaided.

WAKSMAN (S. A.) & FOSTER (J. W.). **Effet du zinc sur la végétation de Rhizopus nigricans et la production d'acide par cet organisme.** [The effect of zinc on the growth of *Rhizopus nigricans* and acid production by this organism.]—*C. R. Acad. Sci., Paris*, ccvii, 12, pp. 483–486, 1938.

Cultures of *Rhizopus nigricans* on a synthetic medium grew three

times more rapidly in the presence of an aqueous solution of zinc sulphate (5 or 15 mg. per l.), judged by the rates of glucose consumption, nitrogen assimilation, and fumaric acid production, than without this element. The compound appears to act as a catalyser of fumaric acid, into which part of the glucose consumed by the fungus is normally converted, but zinc also induces the formation of some other acid or acids as yet unspecified. In other tests it was shown that only a sparse aerial mycelium was formed in cultures devoid of iron and zinc, the addition of which to the medium profusely stimulated both vegetative development and sporulation.

DYKSTRA (T. P.). **A study of viruses infecting European and American varieties of the Potato, Solanum tuberosum.**—*Phytopathology*, xxix, 1, pp. 40–67, 6 figs., 1939.

Descriptions are given of the most prominent symptoms of the following viruses affecting different American and European varieties and some other Solanaceae in the writer's experiments, initiated at Corvallis, Oregon, in 1933, and continued after 1936 at the United States Horticultural Station, Beltsville, Maryland [cf. *R.A.M.*, xv, p. 738]: mild mosaic, crinkle mosaic, crinkle, leaf-rolling mosaic, paracrinkle, and the veinbanding, Y, stipple streak, X, and top necrosis B and C viruses.

The relationship between the different viruses was determined on the basis of (*a*) symptoms on various hosts, (*b*) protective inoculation, (*c*) serological reactions, and (*d*) physical properties, e.g., longevity *in vitro*, tolerance of dilution, and thermal inactivation. Mild and crinkle mosaics, originally described by Schultz and Folsom, and crinkle of European workers (crinkle A of Salaman), though not identical, were found to agree so closely in many respects that the virus, besides X, found in the complex causing each of the three diseases, may be regarded as closely related strains of the same virus, viz., the A virus of Murphy [ibid., xi, p. 740]. Leaf-rolling mosaic (Schultz and Folsom) [ibid., iii, p. 548], distinct from paracrinkle, is attributed to a virus given the new designation E [cf. Bawden's E, the virus of paracrinkle: ibid., xvi, p. 702; xvii, p. 833] with or without X, which seems not to influence the symptoms appreciably. Serological and physical property studies of the veinbanding, Y, and stipple streak viruses denoted a close relationship between the three, all of which are accordingly grouped under virus Y. No affinity could be detected between the veinbanding and cucumber mosaic viruses on the basis of potato and tobacco inoculations, and no protection against cucumber mosaic infection on tobacco was afforded by any of the Y strains. *Amaranthus retroflexus* was shown to be a host of virus X, of which Bawden's virus D, as already demonstrated [ibid., xiv, p. 328], is an aberrant strain. Potato Seedling 41956 was immune from all the strains of virus X tested. Virus B induced top necrosis [ibid., xv, p. 310] in the Arran Victory and President varieties, and is usually carried in a symptomless form, in addition to virus X, by Green Mountain. It was only rarely found in the Bliss Triumph, Burbank, and Earliest of All varieties grown on the Pacific Coast. All the American potato varieties tested reacted to inoculation with virus C by the development of top necrosis [ibid., xvi, p. 53] as a

current-season symptom. Tuber-perpetuated symptoms consist exclusively of mottling, which is also the sole response of healthy plants to grafting with scions from plants arising from such tubers.

CRÉPIN (C.), BUSTARRET (J.), & CHEVALIER (R.). **Cultures de plants de Pommes de Terre en montagne.** [Cultivation of Potato planting material in the mountains.]—*Ann. Épiphyt.*, N.S., iv, 3, pp. 449–480, 6 figs., 4 diags., 1938.

The results of the extensive experiments described in this paper are stated to have largely confirmed the views of the first-named author [*R.A.M.*, xv, p. 597] on the effects of cultivation at high altitudes on the spread and development of virus diseases in potatoes [ibid., xviii, p. 233]. The comparative tests were made from 1932 to 1937, inclusive, with two Dutch (Eerstelingen [Duke of York] and Bintje) varieties, and one German (Cellini) grown from imported seed practically free from disease, and the French variety Industrie, completely infected with mild mosaic but showing slight, fugacious symptoms, at altitudes of about 200 m. and 850 m. in the Jura, 650 m. in the Morvan, and 1,550 m. in the Savoy mountains. At the lowest altitude the spread of virus diseases was very rapid. At the higher altitudes it was much slower and the degree of infection was much less intense, this effect apparently increasing with the altitude, though the minimum elevation for the production of disease-free seed material cannot be determined, since variable environmental, climatic, and ecological factors affect dissemination. The authors claim to have shown that healthy potato seed can be profitably produced in certain mountainous regions of France and that the country ought to utilize its numerous mountains for the production of all the seed potatoes it needs for itself and its colonies.

FAWCETT (G. L.). **Una nueva enfermedad de las Papas.** [A new Potato disease.]—*Circ. Estac. exp. agríc. Tucumán* 67, 3 pp., 2 figs., 1938.

An account is given of a serious potato disease observed since 1937 in Tucumán, Argentine, and characterized by a chestnut discoloration of the tubers to which it owes its local name of 'chocolate'. In 1938, when it was less prevalent than in 1937, the incidence was estimated at 5 per cent. in a number of fields examined. The disease approximates most closely to internal rust spot [*R.A.M.*, xviii, p. 201], from which it differs solely in the absence of chestnut circles and concentric lines [characteristic of spraing, formerly regarded as a type of internal rust spot but now differentiated from it: ibid., xv, p. 468]. Only about half the 'chocolate'-infected tubers planted out at the Experiment Station in March, 1938, germinated and produced healthy plants, the remainder rotting in the ground. The use of tubers from diseased plants for seed is therefore not recommended. The White North American variety showed a certain degree of resistance to the 'chocolate' disease.

A disturbance [of the acronecrotic type] recently reported from Brazil under the name of 'vira-cabeça' ['twisted head'] [ibid., xviii, p. 202] also appears to be closely similar to the condition under discussion, except that the former, tentatively attributed to the 'corcova'

['hunchback'] virus, is characterized by spotting and striping of the leaves and shoots.

WENZL (H.). **Die 'Gelbfleckigkeit' der Kartoffelknollen.** [The 'yellow spotting' of Potato tubers.]—*Phytopath. Z.*, xi, 6, pp. 607–616, 7 figs., 1938.

A new disease of potato, somewhat similar to 'Eisenfleckigkeit' [*R.A.M.*, xviii, p. 50], herein designated yellow spotting of the tubers as distinct from that of the foliage described by Appel (1927), was observed on the Kipfler variety near Vienna in 1936. The diseased tubers, when cut through, showed irregularly distributed deep yellow patches from 2 mm. to 1 cm. in diameter, which appeared translucent in thin sections of the tuber in transmitted light. Towards the spring some groups of cells of the affected parts of tubers became necrotic and turned brown, resembling at that stage the groups of dead cells in potatoes affected by 'Eisenfleckigkeit'. In most of the tubers no outward sign of the disease could be detected but some showed grey patches on the skin immediately above diseased tissue, the colour becoming darker and the skin sinking in when the cells died. Under the microscope the yellow patches were characterized by the almost complete absence of starch grains and by the presence of large masses of crystals 30 to 70 μ in diameter, and numerous yellow chromoplasts about 3 μ in diameter. The colouring substance of these chromoplasts was found to consist of carotin, large amounts of β-xanthophyll, and smaller quantities of a second xanthophyll. The crystals contained a glucoside and quercetin. Three out of four samples of Kipfler potatoes from different parts of the Danube valley, examined in 1937 and 1938, yielded an unexpectedly large number of diseased tubers.

KÖHLER (E.). **Über den vereinfachten Nachweis von X-Virus-Infektionen an der Kartoffel (vorläufige Mitteilung).** [On the simplified detection of X-virus infection on the Potato (preliminary note).]—*NachrBl. dtsch. PflSchDienst.* xviii, 12, pp. 104–105, 2 figs., 1938.

The writer recently isolated from the Up-to-Date potato variety a strain of the X virus, herein designated X^u and characterized by intense pathogenicity to Samson tobacco (Bashi Bagli Stalked), the expressed sap of diseased plants of which, transferred to Starchy potato leaves rubbed with carborundum, induces the formation on the latter of numerous irregular, black, necrotic spots. Such lesions did not develop, however, on the foliage of Starchy potatoes already infected by the X virus. Assuming the applicability of these results to other varieties, the inoculation of rubbed leaves of eye cuttings with the new strain would furnish a simple means of determining the presence or absence of the X virus without resorting to the complicated tobacco test. It is considered not unlikely that the new strain is identical with Bawden's virus B [*R.A.M.*, xvi, p. 53].

CLARK (C. F.), STEVENSON (F. J.), & SCHAAL (L. A.). **The inheritance of scab resistance in certain crosses and selfed lines of Potatoes.**—*Phytopathology*, xxviii, 12, pp. 878–890, 3 figs., 1938.

In preliminary experiments in 1935 on the inheritance of potato

scab (*Actinomyces scabies*) resistance in certain intervarietal crosses and selfed lines at Presque Isle, Maine [*R.A.M.*, xvi, p. 58; cf. also xviii, p. 200], the progeny of a cross between two susceptible parents, Columbia Russet and Katahdin, was completely susceptible, whereas a high degree of resistance was shown by the offspring of two highly resistant parents, Hindenburg and Ostragis. All the other 11 crosses segregated for resistance and susceptibility. The highly susceptible seedlings were immediately discarded, while the more resistant were subjected to a more severe test in 1936. In the progeny obtained, russeting was associated with a high degree of resistance to the pustule types of scab, but the absence of a complete correlation is shown by the fact that each cross contained a number of highly susceptible russeted segregates. Similarly, the whole progeny of the Hindenburg × Ostragis cross, as indicated above, was resistant to scab but segregated for red and white tubers, so that no connexion can be established between reaction to the disease and coloration. Comparing the progeny of selfed Katahdin (russet) with the white segregates of the Richter's Jubel × Seedling 44537 cross, it was evident that the factors for resistance involved in the cross are more numerous or more potent than those concerned in the selfed line.

Discussing the results obtained in the present investigation, the authors conclude that Green Mountain apparently breeds true for susceptibility to scab, Katahdin is susceptible but carries at least one heterozygous factor for scab resistance, Hindenburg and Ostragis are probably homozygous for resistance, and Seedling 44537 and Richter's Jubel are heterozygous.

A number of white-skinned seedlings have been produced that are highly resistant to scab and some of these approach commercial varieties in vigour and yield, though inferior in other characters.

Braun (H.). **Minderung des Pflanzkartoffelwertes durch Befall mit Alternaria solani.** [Reduction of seed Potato value through infection by *Alternaria solani*.]—*NachrBl. dtsch. PflSchDienst*, xviii, 12, pp. 105–106, 1938.

Some figures are cited to show the effect of *Alternaria solani* [*R.A.M.*, xv, p. 394; cf. ibid., xviii, p. 552] on the yield of the crop. Thus, in a preliminary test of 96 Flava tubers in 1937, half of which were attacked by early blight, the total yield from the sound lot amounted to 27·154 kg. and that from the diseased 15·920 kg., representing an approximate difference of 235·42 ± 33·88 gm. between healthy and infected plants. In an experiment in 1938 with 400 sound and 400 diseased Erstling [Duke of York] tubers, the former produced a total yield of 145·63 kg. compared with 113·24 from the diseased, a reduction of 22·4 per cent. as against 41·36 in the previous year, when the incidence of infection was considerably more severe. The difference in yield between healthy and diseased plants in 1938 amounted to 76·76 ± 10·46 gm. It is apparent from these data that early blight infection of the tubers may involve appreciable losses under a certain set of environmental conditions of relatively infrequent occurrence, the nature of which is not yet fully understood.

Magrou (J.) & Bouget (J.). **Présence de mycorhizes chez une Pomme de terre retournée a l'état sauvage.** [The presence of mycorrhiza in a Potato reverted to the wild state.]—*C.R. Acad. Sci., Paris*, ccvii, 26, pp. 1438–1439, 1938.

In one out of three potato root systems from various soil depths at Roquelaure, Gers, France, the roots were found to be extensively infested by a mycorrhizal endophyte [*R.A.M.*, xv, p. 255] occupying the central layer of the cortex, the non-septate mycelium of which formed arbuscular ramifications. Vesicles were not observed. The mycorrhiza under investigation are of the type commonly associated with the wild ancestor of the cultivated potato, *Solanum maglia*, in South America, and it is suggested that their presence accounts for the abundant spontaneous development of the local crop, which has received no cultural attention for the last 20 years.

Bose (S. R.). **The presence of encrusted cystidia in the hymenium of Polyporus zonalis.**—*Mycologia*, xxx, 6, pp. 683–684, 1 fig., 1938.

The author states that in the specimens of *Polyporus zonalis* [*R.A.M.*, iv, p. 636; xv, p. 471] (a common saprophyte) he examined from the eastern tropics and from the United States, he found heavily encrusted cystidia in the basidial layer within the pore tubes; on artificial media the cystidia become very prominent, giving a distinctly warty appearance to the whole culture. These bodies are claimed to constitute an important and reliable diagnostic feature of *P. zonalis*.

Allan (J. G.). **Soil covers on Rubber plantations.**—*India Rubb. J.*, xcvi, 25, pp. 724–725, 1938.

Creeping covers (e.g., *Centrosema pubescens* and *Pueraria*) over white root rot [*Fomes lignosus*] patches on Malayan rubber [*Hevea brasiliensis*] estates [*R.A.M.*, xvii, p. 836] have been found, in the early 'surge' of the disease from previously dormant centres, to carry heavy growths of rhizomorphs of the fungus. In the writer's opinion, the ideal method of dealing with a virgin clearing is not to stump it, but 18 months after burning to inspect all jungle stumps for white rot at a cost of 50 cents per acre. In such a search the presence of rhizomorphs on the covers is a distinct advantage, saving the labour of deeper examination. Bush (such as *Tephrosia candida*) and jungle (high blukar) covers show no aerial rhizomorphs, but prove useful as indicators of white root rot by dying off early as a result of infection.

The incidence of mouldy rot [*Ceratostomella fimbriata*] and of black stripe [*Phytophthora palmivora*] has been found to be equal under creeping covers and in clean areas, but bush or jungle covers over 3 ft. in height definitely encourage panel rots and should be lopped before the onset of the wet season.

The prime factor in the development of pink disease [*Corticium salmonicolor*] is considered to be the persistence of the dew belt; when the trees are seven or eight years old their branches are high enough to escape its influence at night, and the fungus causes no further trouble.

Beeley (F.). **Covers in relation to the incidence and control of diseases and pests in Rubber plantations. Part I. Above ground diseases and pests.**—*India Rubb. J.*, xcvi, 25, pp. 725–727, 1938.

A cover of blukar and rubber [*Hevea brasiliensis*] seedlings has been found less likely to increase the incidence of mouldy rot (*Ceratostomella fimbriata*) in heavily infected smallholdings in Malaya [*R.A.M.*, xvii, p. 837 and preceding abstract] than grass (alone or with seedling blukar), while slashed seedlings or forest covers without grass are still more favourable in this respect. Creeping covers on limestone or coastal clay soils raise the degree of atmospheric humidity at 4 ft. above ground-level from between 65 and 70 to 80 per cent. and appear to promote the foot, panel, and stem canker group of diseases (*Phytophthora* and *Pythium* spp.) rather than mouldy rot.

Recent cross-inoculation experiments provided no evidence that the strain of *Corticium salmonicolor* from *Desmodium ovalifolium*, large areas of which have been killed by pink disease, is parasitic on rubber or vice versa. However, the appearance of the disease in the cover is thought to indicate the gradual development of conditions conducive to rubber infection, and at this juncture moderate slashing may be advisable to bring about a drier atmosphere. For the treatment of *C. salmonicolor* in young rubber plantings a water-miscible fungicide is recommended for green, and an asphalt-kerosene or tar mixture for mature brown bark. A disease of cover bushes liable to confusion with *C. salmonicolor* is caused by *Irpex subvinosus*, which produces a pinkish-mauve to nearly purple felt over several inches of the stem; it is not known to attack rubber.

Alcorn (G. D.) & Yeager (C. C.). **A monograph of the genus Cunninghamella with additional descriptions of several common species.**—*Mycologia*, xxx, 6, pp. 653–658, 1 fig., 1938.

The authors give a description of the eight known species of the genus *Cunninghamella*, together with a key of the species. Soil forms of *C. elegans* [*R.A.M.*, xiv, p. 249] and *C. bertholletiae* have been encountered so different from the original descriptions as to be identified only after comparison with tester strains.

Waksman (S. A.), Umbreit (W. W.), & Cordon (T. C.). **Thermophilic Actinomycetes and fungi in soils and in composts.**—*Soil Sci.*, xlvii, 1, pp. 37–60, 4 pl., 1939.

In addition to six distinct types of thermophilic Actinomycetes of two genera, *Actinomyces* and *Micromonospora*, stable manure composts kept at 50° C. at the New Jersey Agricultural Experiment Station developed a very characteristic population of thermophilic fungi (reaching a maximum of 200,000,000 per gm. in ten days), the majority of which belong to the ill-defined group known as *Thermomyces* (*Ann. Inst. Pasteur*, xvii, pp. 217–240, 1903). This representative of the Fungi Imperfecti produces black chlamydospores on short lateral branches of the mycelium, and was found to be capable of decomposing the organic constituents of the substratum, including hemicelluloses, cellulose, and lignin, almost in their entirety: in an inoculation experiment it disorganized 40 per cent. of the total manure as compared with 62 per

cent. for the mixed population of thermophilic Actinomycetes and bacteria. The fungi appeared to be of great importance in the sequence of population in the 50° C. compost, developing profusely within 18 hours of incubation, sporulating rapidly, and being followed by bacteria, many of which seemed to grow largely at the expense of the mycelium.

VENKATA RAO (M. G.). **The influence of host plants on Sandal and on spike disease.**—*Indian For.*, lxiv, 11, pp. 656–669, 3 pl., 1938.

The author states that with the object of finding a host of sandal [*Santalum album*] likely to induce immunity from spike disease [*R.A.M.*, xvi, p. 340; cf. also xvii, p. 626], 108 different host plants [which are listed] were grown with sandal in pot cultures and the sandal tested for resistance by artificial inoculation. In none of the combinations tried was the sandal immune from the disease; differences in susceptibility, if any, were generally slight and within the limits of experimental error.

RANDS (R. D.) & DOPP (E.). **Pythium root rot of Sugarcane.**—*Tech. Bull. U.S. Dep. Agric.* 666, 96 pp., 4 pl., 12 figs., 7 graphs, 1938.

While the principal cause of sugar-cane root rot in the United States is *Pythium arrhenomanes* [*R.A.M.*, xvii, p. 487], twelve other species of *Pythium* and several other fungi have been isolated from decaying roots examined in surveys made in the Gulf States. These fungi were most prevalent in Louisiana, where the roots had been injured or weakened by various factors. Greenhouse infection experiments with these organisms failed to give the general root rot symptoms characteristic of *P. arrhenomanes*, while the same fungi did not act as secondary invaders to *P. arrhenomanes*. The addition of the toxic salicylic aldehyde [loc. cit.] (50 p.p.m.) to the soil, however, predisposed the sugarcane to attack by several of these miscellaneous species, notably *P. dissotocum* [ibid., x, p. 211] and *P. graminicolum* [ibid., xvi, p. 561]. The results (together with survey records) indicate that none of these fungi is an important factor in sugar-cane rot disease save under very exceptional circumstances.

Greenhouse inoculation tests with over 200 isolates of *P. arrhenomanes* from Louisiana demonstrated the existence of physiologic specialization and of some degree of varietal adaptation in this species. There were also significant differences in the average virulence of the isolates as between different localities and the periods 1927 to 1931 and 1935 to 1936, actual increase in average virulence apparently having occurred between the two periods. This may, possibly, be due partly to the general adoption of newer and more resistant varieties, with the result that only the more virulent or adaptable components of the earlier population of the fungus survived.

The yield of the susceptible P.O.J. 234 variety in relation to the highly resistant Co. 290 and C.P. 807 varieties in comparative replicated field tests during the last eight years has shown marked decline and has been associated with an apparent increase in the severity of infection. Resistant varieties, on the other hand, have not shown any increased root rot. *P. arrhenomanes* is evidently a dynamic rather than a static factor in sugar-cane production, and resistance tests of new seedlings require artificial inoculation of the soil with the most virulent strains found in the locality.

In varietal field tests, most of the 'noble' canes were highly susceptible, while the Chinese canes (*Saccharum officinarum*) and the wild cane (*S. spontaneum*) were very resistant, and the Indian varieties of *S. barberi* were intermediate. F_1 hybrids from crosses between 'noble' and wild canes were generally resistant, but successive back-crossing to the 'noble parent' gave increasing susceptibility in the few cases studied. Among commercial varieties grown in Louisiana, Co. 290, C.P. 807, C.P. 28/11, and C.P. 29/116 are resistant to root rot and sufficiently vigorous to plant in mixed and heavy soils, though C.P. 807 is very susceptible to red rot (*Colletotrichum falcatum*), to which C.P. 29/320, so far not seriously affected by root rot, has also been reported as susceptible. Co. 281 and C.P. 28/19 are susceptible to root rot, and as a rule grow successfully only in light, well-drained soils.

Evidence was obtained confirming the view that high winter rainfall and low spring temperatures increase the damage to canes planted in the autumn. The heavy losses in yield sometimes incurred when C.P. 28/19 is planted in October in heavy soils were obviated by summer planting. In tests in controlled soil temperature tanks root rot was most severe at 65° to 68° F., becoming progressively less serious with increasing temperatures up to 97°. Improvement of root rot soils by the continued ploughing in of all trash, moderate applications of factory filter-press cake, or stable manure, and good drainage appreciably reduced root rot damage in susceptible canes. Increased root rot of plant cane has also been observed apparently to result from excessive nitrogen fertilization of the parent crop.

Abbott (E. V.). **Red rot of Sugarcane.**—*Tech. Bull. U.S. Dep. Agric.* 641, 96 pp., 10 pl., 7 figs., 3 graphs, 1938.

A detailed survey carried out in the sugar-growing areas of the United States indicated that the light and dark races of *Colletotrichum falcatum* [*R.A.M.*, xvi, p. 127: xvii, p. 67] have been responsible for the failure of P.O.J. 213 and the decline of C.P. 807, respectively. In the syrup-producing States the dark race predominated from 1930 to 1937, but in 1938 the light race predominated on all varieties except Cayana; only light-race isolates were found in Florida.

Measurements of the conidia of 81 isolates failed to establish any correlation between conidial size and the cultural characters differentiating the light and dark races, which, further, could not be differentiated by rate of growth in culture. The optimum growth temperature for the fungus was from 30° to 32·5° C.; growth was poor at 37°, slow at 15°, and absent at temperatures below 10°. Dark- and light-race isolates indistinguishable from those obtained from sugar-cane leaves and stalks were obtained from the midribs of the leaves of *Sorghum halepense*, *S. vulgare*, and *Erianthus giganteus*.

Infection of sugar-cane leaves was found to be important as a primary source of conidial inoculum for stalk infections. Leaf infection generally occurs through wounds made by insects, but penetration of apparently uninjured epidermis may take place. Stalk infections of standing cane find ingress largely through the tunnels bored by *Diatraea saccharalis* and, in some highly susceptible varieties, through the root primordia. Infection may also take place through the cut ends of

seed cuttings. The disease develops in winter in seed cane from infections that have taken place before cutting and planting. During spring, conidia produced on trash, pieces of seed cuttings, and stubble rhizomes serve as sources of inoculum for infection of the leaves. No evidence was obtained that the fungus persists in the soil.

Tested on the resistant Co. 281 and the very susceptible P.O.J. 213 canes, the light race from Louisiana was, as a rule, more virulent than the dark race from the same State, the latter being more virulent, however, than either the light or dark race from the syrup-producing States. The two races from the last-named region were of approximately equal virulence.

Comparison of light-race isolates from P.O.J. 213 in Louisiana with light-race isolates from other commercial varieties demonstrated that the P.O.J. 213 isolates were, as a group, significantly more virulent than the other groups, except those from P.O.J. 36–M. The dark-race isolates from C.P. 807 taken from localities where infection was severe were significantly more virulent than those from areas where this variety was less severely affected. Differences in relative virulence were found among the dark races similar to most of the light races. Evidence was obtained that the absence of red rot injury to P.O.J. 213 in the syrup-producing States is due to the lower virulence of the races of *C. falcatum* present. Hence, although well-defined physiologic races could not be differentiated, a degree of specialization within both the light and dark types was established.

The results of laboratory and field inoculation tests showed that very vigorous but susceptible cane varieties may suffer less severely from red rot than more resistant but less vigorous ones. Moderately resistant varieties susceptible to root rot [chiefly *Pythium arrhenomanes*: see preceding abstract] were sometimes more severely injured by red rot than susceptible varieties resistant to root rot. High susceptibility is characteristic of *Saccharum officinarum*, while of two varieties of *S. barberi* one was very susceptible and one moderately resistant; *S. sinense* was only slightly less susceptible than *S. officinarum*, and the one variety of *S. robustum* tested was susceptible. Of 14 varieties of *S. spontaneum*, 13 were moderately resistant and 1 was very susceptible.

A study of the distribution of resistance among the seedlings of four complete progenies failed to disclose any correlation between resistance and the growth habit of the female parent, Co. 281, the agronomic character of the seedlings, or the sucrose content of the juices. From other evidence it was concluded that Co. 281 is of high value as a parent in breeding for resistance.

In C.P. 807, resistance of the host tissues to the spread of the fungus was found to be more important than resistance to invasion through the root primordia. The principle of resistance appears to be contained within the protoplasm.

Caminha (A.). **Correlation between intensity of mosaic infection of Sugar Cane and environmental adaptability.**—*Brasil assuc.*, xi, 6, pp. 30–33, 1938. [? Portuguese. Abs. in *Facts ab. Sug.*, xxxiv, 3, pp. 39, 1939.]

Certain soil and atmospheric conditions have been observed to predispose sugar-cane to a greater or lesser degree of susceptibility or

resistance to mosaic. For instance, certain varieties, such as P.O.J. 213 and 36, are resistant in the Argentine, somewhat tolerant in the southern States of Brazil, and definitely susceptible in the tropical regions of the north [*R.A.M.*, xvi, p. 126]. The variety H. 109, absolutely immune in Hawaii, has succumbed to mosaic in most or all of the other countries to which it has been transplanted, while P.O.J. 213 is also extremely susceptible in Java. These observations might suggest that the virulence of mosaic tends to be greater in tropical regions than elsewhere, but the reverse is the case with Diamond 10, resistant and a prolific yielder in British Guiana but highly susceptible when transplanted to the subtropical Argentine. Possibly the explanation of this complex problem lies in an alteration of the ability of the plant, on transference to new surroundings, to develop antibodies repelling the mosaic virus.

PICKEL (D. B.). **As molestias mais perniciosas da Cana de Açucar en Pernambuco.** [The most serious diseases of Sugar-Cane in Pernambuco.]—*Biologico*, iv, 11, pp. 361–367, 2 figs., 1938.

The author states that sugar-cane mosaic in Pernambuco is very nearly extinct, chiefly owing to the climate, which is distinctly favourable to the crop, but also in consequence of the measures carried out for its eradication. The only serious disease of sugar-cane in that province is a root rot, the first symptoms of which become apparent at the beginning of the dry season, very frequently terminating in the death of the affected stools. It is especially prevalent on hard clay soils, or in fields subject to waterlogging during the wet season. The primary cause of the trouble is considered to be root asphyxiation, and the very frequent association of *Himantia stellifera* [*R.A.M.*, xvii, p. 299] with it is held to be secondary.

BITANCOURT (A. A.). **'Pyrenochaeta sacchari n.sp.' e uma mancha da folha da Cana de Açucar.** ['*Pyrenochaeta sacchari* n.sp.' and a leaf spot of Sugar-Cane.]—*Arq. Inst. biol., S. Paulo*, ix, 27, pp. 299–302, 2 pl., 1938. [English summary.]

An account is given of an apparently undescribed leaf spot observed by the author in the autumn of 1937 on sugar-cane of the EK 28 variety in plantings of the Phytopathological Section at Cantareira, São Paulo. The first symptom develops on relatively young leaves in the form of small, regular, oval, well-delimited, and almost pure white spots, 1·5 to 6 by 1 to 3 mm., on the lower surface, the corresponding spot on the upper surface being smaller and much less conspicuous. These chlorotic markings are more or less dispersed, but when numerous, as, for instance, in the apical half of the leaves and along the two sides of the main vein, they may coalesce. On ageing the individual spots become surrounded by a thin, Corinthian purple line and assume a vinaceous-buff colour; where the spots coalesce the purple line disappears between the spots but surrounds the whole aggregation, which may attain considerable size and is very irregular in shape. In their later stages of development the spots may be confused with those due to *Leptosphaeria sacchari*. All the spots examined bore amphigenous pycnidia of a fungus which is described [with a Latin diagnosis] as new to science under the name *Pyrenochaeta sacchari*. The pycnidia are

superficial or slightly immersed, colourless at the base but blackish towards the apex, mammiform or subglobose, 50 to 100 μ in diameter, glabrous or provided with 1 to 20 radially disposed, erect or tortuous, fuliginous, cylindrical, apically obtuse setae, from 5 to 40 by 2·5 to 5 μ. The conidia are hyaline, continuous, oblong, subacute at the apex, and 6 to 12 by 3 μ in diameter. The author states that inoculation experiments with the fungus have, so far, given negative results, but its constant association with the leaf spot leaves little doubt of its pathogenic activity.

Pilát (A.). **Liste der von A. C. J. Corda beschriebenen Pilzarten, mit Angabe der Originalexemplare, die im Herbarium des Nationalmuseums in Prag aufbewahrt sind.** [A list of the species of fungi described by A. C. J. Corda, with information on the original specimens preserved at the herbarium of the National Museum in Prague.]—*Acta Mus. nat. Pragae*, iB, 10, pp. 139–170, 1938. [Czech summary.]

Lists are given of (*a*) the species of fungi described and figured by Corda, including a large number represented by type specimens at the National Museum of Prague, (*b*) species designated by new names in Corda's herbarium but not described or figured and in some cases renamed in his published works, and (*c*) authentic specimens of fungi furnished by various mycologists, chiefly Berkeley, Léveillé, and Montagne. The material in question, comprising some 400 specimens, was brought to light in the course of the author's rearrangement of the Museum herbarium in 1932.

Hopkins (J. C. F.) & Mossop (M. C.). **The spraying of Tobacco seed beds and control of rosette disease.**—*Rhod. agric. J.*, xxxv, 10, pp. 760–764, 2 figs., 1938.

During the last twelve months, tobacco 'rosette' [*R.A.M.*, xviii, p. 278] has become widely prevalent in Rhodesia. Transmission of the virus from diseased to healthy plants has been proved to take place by means of the aphid *Myzus persicae*, which is a much more efficient carrier of the disease than whitefly [*Bemisia* sp.] is of leaf curl.

Rosette has been observed on several occasions in seed-beds in the Lomagundi district. The first symptom on young seedlings is a slight downward curling of the tip of one of the youngest leaves just emerged from the bud. The plant continues growth, and the affected leaf puckers up. Subsequent leaves become similarly affected, the distortion becomes more marked, and finally a rosette of twisted, puckered leaves develops in the crown, and growth becomes arrested.

In addition to spraying every five days with Bordeaux-lead arsenate-nicotine mixture (8–1½–16 fluid oz. 40 per cent. extract–50 plus a spreader), growers are strongly advised to remove and destroy immediately all affected seedlings, to exclude all tobacco re-growth from fallow lands, to cease growing tomatoes, potatoes, and *Zinnia* in the vicinity of tobacco, as it appears that these are hosts of the virus, and to eradicate weed hosts, especially *Solanum nigrum* and *Nicandra physaloides*, from the seed-bed sites. All residual plants must be destroyed as soon as each bed is finished with.

Price (W. C.) & Wyckoff (R. W. G.). **Ultracentrifugation of juices from plants affected by Tobacco necrosis.**—*Phytopathology*, xxix, 1, pp. 83–94, 2 figs., 1939.

The juice of Turkish tobacco plants infected by the tobacco necrosis virus [*R.A.M.*, xviii, p. 211] yielded on quantity ultracentrifugation a characteristic macromolecular substance, purified solutions of which sediment with a single sharp boundary and a constant of $S_{20°} = ca$ 112×10^{-13} cm. sec.$^{-1}$ dynes^{-1}.

Substances with the same sedimentation constants have been isolated from cucumber, cowpea, and *Nicotiana glutinosa* plants infected by the tobacco necrosis virus. The amounts of macromolecular substances obtained are roughly proportional to the infectiveness of the host juices. The infectious juices from diseased cucumber and cowpea plants contain lighter components probably identical with the pigmented macromolecular substances occurring in appreciable quantities in healthy representatives of the same species. Small amounts of similar non-infectious macromolecules have also been found in healthy Turkish tobacco and *Nicotiana glutinosa* juices. All these substances have the same sedimentation constant, viz., $S_{20°} = ca$ 75×10^{-13} cm. sec.$^{-1}$ dynes^{-1}, except those in cowpea, for which the corresponding formula is $S_{20°} = 51 \times 10^{-13}$.

Johnson (J.). **Plant virus inhibitors produced by micro-organisms.**—*Science*, N.S., lxxxviii, 2293, pp. 552–553, 1938.

Laboratory studies showed that *Aerobacter aerogenes* and *Aspergillus niger* in culture produced a substance or substances which, when added to an extract of tobacco mosaic, immediately inhibited the infectivity of the virus. It was not toxic, however, to bacterial, fungal, or higher plant cultures, and in this respect resembles charcoal, *Phytolacca* juice, and trypsin. The inactivation of the virus being instantaneous, it is apparently not due to decomposition or digestion. The substance was appreciably concentrated by evaporation of the medium, the inactivator partly withstanding 100° C. for some hours. In a 0·1 per cent. aqueous solution of the dried broth culture, the product was normally active and retained most of its activity at 0·1 per cent. concentration. A normal concentration completely inactivated an equal volume of undiluted extract of ordinary tobacco mosaic, and was equally effective on several other plant viruses. The inactivator passed bacterial-proof filters with markedly reduced potency. Activity was retained for months in the original culture, a heat-sterilized culture, and in a state of desiccation. The substance also withstood high concentrations of alcohol, chloroform, mercuric chloride, and charcoal. It differed markedly from the *Phytolacca* juice and trypsin inhibitors in its ability to tolerate higher temperatures, as well as in other respects.

Goldin (M. I.). **I. Tobacco-mosaic virus as influenced by micro-organisms. II. Adsorption of Tobacco-mosaic virus by micro-organisms.**—*C.R. Acad. Sci. U.S.S.R.*, N.S., xx, 9, pp. 735–740, 1938.

The first of these two papers on the relations between viruses and micro-organisms in culture and under natural conditions describes a

series of experiments in which both the non-sterile tobacco mosaic virus [*R.A.M.*, xvii, p. 809] in tomato juice and the sterile filtrate (filtered through L3 candles) were more rapidly inactivated (at 25° C.) under aerobic than under anaerobic conditions. The sterile filtrate of the virus was found to lose its activity almost completely on the second day in the presence of a pure culture of *Torula kefiri* under aerobic conditions, while it remained active for over six months in a culture of *B[acillus] mycoides*, *B[acterium] coli comm[unis]* occupying an intermediate place. Regular records of the hydrogen-ion concentration showed that the effect of the organisms on the virus was not conditioned by changes of P_H.

In experiments on the adsorption of tobacco mosaic virus by micro-organisms, described in the second paper, samples of juice of tomato infected with either ordinary tobacco mosaic virus or with the crystalline virus, both previously filtered through L3 candles, were added to cultures of micro-organisms with different P_H values, flasks without micro-organisms serving as controls. All flasks were kept for two hours in a thermostat at 37° and then for 24 hours in a refrigerator, after which all preparations were centrifuged three or four times for five minutes at a speed of 1,000 r.p.m., the supernatant liquid decanted each time, and finally the virus content of the sediment and of the last washing liquid was determined by inoculation on *Nicotiana glutinosa*. The results showed that the virus was adsorbed by *Bacillus mycoides* and *Schizosaccharomyces*, particularly in an acid medium.

Blue mold (downy mildew) of Tobacco and its control.—*Bull. Va agric. Exp. Sta.* 318, 18 pp., 8 figs., 1938.

A popular account is given of the economic importance, symptoms, and the causal fungus of tobacco downy mildew [*Peronospora tabacina*: *R.A.M.*, xvii, p. 275; xviii, p. 63] in the United States, together with a discussion of the factors favouring the disease [ibid., xvi, p. 64] and methods of control. The use of narrow seed-beds (not more than 2 yds. wide) is strongly recommended, partly because they facilitate control operations. Detailed practical directions are given for control by fumigation with benzene or paradichlorbenzene [ibid., xvii, p. 844] and spraying with red copper oxide, emulsified cottonseed oil, and water [ibid., xvii, p. 275]. Experience to date indicates that 1 oz. paradichlorbenzene crystals is sufficient for each 4 or 5 sq. yds. of bed area, but if the disease is already present twice or three times this amount should be used for two or three successive nights. When the disease has been checked the smaller dosage of crystals should be applied and the supply replenished every night. The cloth for covering the beds during fumigation should be heavy sheets, with 50 to 60 threads each way per in. The red copper oxide spray now recommended comprises $\frac{1}{2}$ lb. red copper oxide, $\frac{1}{2}$ gal. cottonseed oil, and either 1 qt. lethane spreader, $\frac{1}{2}$ to $\frac{3}{4}$ pt. orvus, or $\frac{1}{2}$ to $\frac{3}{4}$ lb. dreft in 50 gals. water. [This bulletin is reprinted as *Circ. Coll. Agric. Ky.* 329, 18 pp., 8 figs., 1939.]

PINCKARD (J. A.) & SHAW (L.). **Downy mildew infection of flue-cured Tobacco in the field.**—*Phytopathology*, xxix, 1, pp. 79–83, 4 figs., 1939.

Two distinct types of infection by downy mildew (*Peronospora

tabacina) were observed on flue-cured tobacco [see preceding abstract] in the Old Belt of North Carolina and Virginia in 1938. One was characterized on Yellow Mammoth by aggregated yellow spots, individually resembling those caused by *Bacterium angulatum* and collectively producing a blotched appearance. In some cases the small lesions composing the blotches coalesced into large necrotic areas, 10 to 20 mm. in diameter. Sporulation was not observed on lesions of this kind, which persisted almost unchanged until early July and apparently represent a more or less static phase of the disease. The second type of infection consisted of ill-defined chlorotic areas of varying size and number per leaf, which eventually developed into large, well-marked necrotic lesions, frequently coalescing to involve most of the leaf surface; finally they disintegrated and fell out, leaving ragged holes. Sporulation occurred on these lesions, especially after necrosis had set in. Favourable conditions for dissemination, infection, and the development of mildew in the field were no doubt provided by a rainy spell during the latter half of May. Viable sporangia were repeatedly collected from seed-beds, which probably constitute foci of inoculum for the field and should therefore be destroyed as soon as possible after the crop has been transplanted.

JEWETT (FRANCES L.). **Relation of soil temperature and nutrition to the resistance of Tobacco to Thielavia basicola.**—*Bot. Gaz.*, c, 2, pp. 276–297, 37 figs., 1938.

When Ordinary White Burley (susceptible), Resistant White Burley (resistant), Connecticut Havana 38 (resistant), Havana 142 (very resistant), and Xanthia (extremely resistant) tobacco plants were grown in the greenhouse in soil temperature tanks containing nutrient solution with and without nitrate nitrogen at soil temperatures of 18° to 20° and 28° to 30° C. and were inoculated with pure cultures of the black root rot fungus, *Thielavia* [*Thielaviopsis*] *basicola*: [*R.A.M.*, xvii, p. 774], the susceptibility or resistance of each variety remained unaffected at any given temperature by the presence or absence of nitrogen in the nutrient. Evidence is adduced that low soil temperature favours infection and varieties resistant at high temperatures are rendered susceptible at low ones. The development of resistant varieties, however, remains the best practical method of control.

Periderm formation in control plants was not correlated with resistance and there was no evidence of periderm formation in advance of the fungus or round lesions produced by it. Response to fungal injury was similar to reaction to mechanical wounding. Callus formation in infected roots and stems appeared to be regenerative rather than defensive. It is concluded that the mechanism of resistance is probably due to chemical factors rather than to anatomical modifications.

McWHORTER (F. P.) & MILBRATH (J. A.). **The tipblight disease of Tomato.**—*Circ. Ore. agric. Exp. Sta.* 128, 14 pp., 4 figs., 1938.

The tomato virus disease known in southern Oregon as tip blight [*R.A.M.*, xv, p. 182] infected from a trace to about 20 per cent. of the crop during the years 1932 to 1937 and caused a directly proportional loss of yield, since infected plants either die or yield only unmarketable

fruits. Individual growers may sustain much heavier losses, even to the complete destruction of the crop. The disease appears in the latter part of June but does not become widely prevalent until July or August.

The most conspicuous symptom in the Indiana Canner variety is marked blighting and blackening of the terminal shoots. The dead tips stand perpendicularly above the living foliage, and show black patches and brown streaks that subsequently turn silver-grey. The stems are hollow, the pith in the region of the tip being arranged in scattered patches, with air-pockets in between. The leaves of affected shoots show a few large or numerous small, black, necrotic spots on both surfaces; these may enlarge and coalesce.

Six to eight days after the inoculation of a leaf, one or more lesions appear at the point of inoculation; two to five days later, black streaks appear on the stem at the base of the inoculated leaf. As the virus spreads up the stem, minute black spots appear on both surfaces of the leaves, enlarging in a day or two into characteristic lesions. Small plants succumb within about 14 days of inoculation. If infection develops while the flowers are opening, lesions may occur on the fruit spur and calyx, causing the flowers only, or the whole fruit spur to become blighted. The development of small fruits is arrested, and irregular brown spots appear on the green surfaces. Fruits more than 1 in. in diameter do not continue to enlarge, but ripen abnormally, turning soft, and showing yellow, orange, and red blotches and rings. The larger fruits ripen unevenly. The underground parts are invaded by saprophytes.

Apparently healthy leaves immediately below infected ones on a diseased shoot, if floated for about 20 hours in water, develop a characteristic greenish-black speckle if tip blight is present. This test may be used under field conditions to distinguish tip blight from bacterial canker (*Bacterium* [*Aplanobacter*] *michiganense*).

Transmission of the disease was effected by grafting and by the carborundum method, provided the infectious juice was taken from recently infected plants and rubbed into vigorous ones. *Thrips tabaci* was commonly present in the affected fields, and when this insect was transferred from naturally infected plants to 31 healthy tomato plants, 13 of the latter developed lesions on the exposed leaves, and five of these plants subsequently developed systemic symptoms.

Inoculations of local weeds with juice from diseased tomato plants gave 100 per cent. positive results with *Solanum nigrum* and *Lactuca scariola*, and 19 out of 35 positive results on *Datura stramonium*, a number of other wild hosts responding by the production of local lesions only.

The removal of all diseased tomato plants early in the season and of all weeds is likely to reduce loss. Localities known to favour the disease should not be used for tomato-growing. Progress has already been made in the development of resistant varieties.

Horsfall (J. G.), Magie (R. O.), & Suit (R. F.). **Bordeaux injury to Tomatoes and its effect on ripening.**—*Tech. Bull. N.Y. St. agric. Exp. Sta.* 251, 39 pp., 5 figs., 11 graphs, 1938.

To investigate the causes of the failure of Bordeaux mixture to give

increased yields of tomatoes commensurate with the degree of control obtained over leaf diseases [*R.A.M.*, xvi, p. 714; xvii, p. 712], field and greenhouse tests were carried out in New York from 1929 to 1938, inclusive, in which tomato plants were sprayed with Bordeaux mixture (4–4–50) and (4–2–50), lime alone, and insolubilized copper compounds without lime, and measurements made of growth, blossoming, and fruiting.

The results showed that Bordeaux mixture produced both hyperplastic and hypoplastic symptoms. The former consisted of dark green foliage, stimulation of adventitious buds, accelerated transpiration [ibid., xvi, p. 844], larger fruits, smaller growth cracks, russeting, and an increased tendency of the pedicel to adhere to the fruit when picked. The latter appeared as hardening of the leaves, plant dwarfing, leaf and fruit deformation, reduced blossom-bud development, defloration, and reduced yield.

The darker green of the sprayed foliage is attributed to an optical effect and to copper stimulation, the stimulation of adventitious buds to the killing of meristems, and the larger fruits to their smaller number. Leaf hardening took the form of turgidity due, apparently, to the effects of the copper, and of woodiness due, apparently, to those of calcium. The plant dwarfing is attributed to accelerated transpiration, plugging of the stomata with resultant reduced photosynthesis, and hardening caused by the lime, which impeded cell expansion. The reduction in blossom-bud development was in proportion to the dwarfing, and, with the defloration, resulting apparently from direct copper toxicity, accelerated transpiration, and calcium hardening, was the cause of the reduction in yield.

Much of the injury appeared to be related to the alkalinity of the mixture, similar damage being occasionally produced by acid, and not by neutral, sprays.

Dorokhov [Dorokhoff] (L. M.). **Alteration of physiological processes in Tomato under the influence of Cladosporium fulvum Cke.**— *C.R. Acad. Sci. U.R.S.S.*, N.S., xxi, 1–2, pp. 85–88, 1938.

In experiments carried out in Moscow in 1936, seeds of the Sparks Gribivsky variety of tomato germinated quite normally in Richards's solution diluted to 25 per cent. strength, while only 18 to 40 per cent. germinated in a 25 per cent. solution of the culture filtrate of *Cladosporium fulvum* [*R.A.M.*, xviii, p. 142] grown on Richards's medium. No germination at all occurred in concentrations of the filtrate exceeding 25 per cent. Seeds inhibited by exposure to a culture filtrate germinated after 24 hours when washed and transferred to Petri dishes.

In further experiments the majority of tomato plants grown on a 1, 5, 10, or 25 per cent. filtrate from *C. fulvum* cultures, or of plants grown from seeds kept for 10 to 15 days in a 50 to 75 per cent. culture filtrate prior to germination, perished when transferred to Knop's nutrient solution, and the surviving plants had under-developed yellow leaves. When tomato plants were grown on Knop's nutrient solutions to which 5, 10, or 25 per cent. concentrations of the culture filtrate were added, the 25 per cent. filtrate poisoned the plants, which died in 30 to 35 days, while with the 10 and 5 per cent. filtrates the plants

survived, but showed yellowing and drying up of young leaves or yellowing only, respectively. It is concluded from these results that *C. fulvum* excretes into the nutrient medium toxins which suppress the development of the seed embryo and, when introduced into the plant, cause a partial or total poisoning of the host cells and break up the chlorophyll. The photosynthesis and still more the respiration of tomato leaves were found to be lowered by infection with *C. fulvum*, whereas the transpiration of infected leaves increased considerably.

Bernal (J. D.), Fankuchen (I.), & Riley (D. P.). **Structure of the crystals of Tomato bushy stunt virus preparations.**—*Nature, Lond.*, cxlii, 3607, p. 1075, 1938.

X-ray examination of crystals of protein material obtained from tomato bushy stunt [*R.A.M.*, xviii, p. 143] showed them to be isotropic rhombic dodecahedra of average diameter (0·01 mm.). Data obtained from photographs made with a monochromatic beam of copper $K\alpha$ radiation at 40 cm. indicated a particle diameter of 340 Å or a radius of 17mμ. The density of the crystals in solution was 1·286, so that, assuming two particles per cell, the wet molecular weight is 24,000,000. When dried and again wetted the crystals shrank and swelled reversibly, shrinking amounting to 80 per cent. of the wet dimensions. An X-ray photograph of a crystal dried over phosphorus pentoxide showed almost precisely the same shrinkage. Assuming that the density of 1·35 computed by McFarlane and Kekwick is that of the dry crystals, the molecular weight would be 12,800,000, as against the figure of 8,800,000 found by the same workers by the centrifuge method [loc. cit.], a discrepancy possibly resulting from some of the water in the crystal being held zeolitically and lost without further shrinkage.

Arruda (S. C.). **A septoriose ou mancha da folha do Tomateiro.** [Septoriosis or leaf spot of Tomatoes.]—*Biologico*, iv, 12, pp. 389–392, 1 fig., 1938.

This is a popular account of the leaf spot of tomato (*Septoria lycopersici*) [*R.A.M.*, xvii, p. 140] and its control in Brazil, where the disease is present wherever the tomato is grown, and is especially destructive on soils cropped with tomatoes for several years consecutively.

Guba (E. F.). **A red forcing Tomato resistant to Cladosporium leaf mold.**—Abs. in *Phytopathology*, xxix, 1, p. 9, 1939.

A red tomato combining resistance to leaf mould (*Cladosporium fulvum*) with other desirable commercial qualities has been developed for greenhouse culture at Waltham, Massachusetts [*R.A.M.*, xviii, p. 142] from original hybrids between the resistant *Lycopersicum pimpinellifolium* and Success, Belmont, and Break o' Day, and from subsequent crosses of progeny of these hybrids, pure lined for resistance, with Waltham Forcing. The new selection from the latest hybrids is named Bay State.

Guba (E. F.) & Rackemann (F. M.). **Species of Cladosporium on Tomato and the allergic response in Man as an aid to their identification.**—*Mycologia*, xxx, 6, pp. 625–634, 1 fig., 1938.

From a review of the relevant literature the authors conclude that

Cladosporium fulvum var. *violaceum* Plowr. and *C. solani* McAlpine, both recorded as causing leaf mould of tomatoes, are synonymous with *C. fulvum* [R.A.M., xviii, p. 142]. Accounts of decay of tomato fruits associated with these fungi are due to erroneous identifications, and *C. lycopersici*, to which is frequently attributed transit and other decays of tomatoes, appears to be the same as *C. herbarum*. The latter would also seem to be the better name for *C. lycoperdinum*, reported by Ellis on tomato fruits. Intracutaneous injections of extracts of *C. fulvum* and several other *C.* species into individuals susceptible to asthma caused by *C. fulvum* resulted in markedly varied reactions with the species tested; the differences were specially noticeable between the reactions to *C. fulvum* from greenhouse tomato leaves and to *C. herbarum* from rotted tomatoes and peppers [? *Capsicum annuum*]. This biologic test appears to be a new method by which closely related fungi may be differentiated from one another with considerable certainty.

STRONG (F. C.). **Some important shade tree diseases of the Mid-West.**— *Proc. nat.* [*U.S.*] *Shade Tree Conf., 1938*, pp. 106–118, 7 figs., 1938.

In this paper the author discusses the more important parasitic and non-parasitic diseases of shade trees observed during the past ten years in the mid-western States.

For the control of the increasingly important cedar-hawthorn rusts (*Gymnosporangium* spp.) it is recommended to plant junipers at least half-a-mile away from crab apples and hawthorn in order to prevent infection, to eliminate all trees of one of the host groups from the particular area entirely, or to use resistant varieties. A severe and general epidemic of the leaf spot and twig blight [*Gnomonia veneta*] of sycamore [*Platanus*] and white oak [*Quercus* (?) *alba*] occurred throughout the north-central States in 1930, but generally leaf diseases of trees were only locally severe. Heavy infection by leaf spot [*G. leptostyla*: *R.A.M.*, xii, p. 251] commonly hastened the leaf fall of walnuts by up to a fortnight. Elm leaf spot [*G. ulmea*: ibid., xviii, p. 11] appeared on susceptible individual trees year after year. Apart from these, many other leaf diseases of minor importance were observed. The major problem was constituted by the wilt diseases of elms and maples [cf. ibid., xviii, p. 281]; about 34 per cent. of the elm trees examined showed the presence of some of the wilt organisms, the remainder being apparently affected by adverse conditions of weather and soil. Prompt removal and burning of affected parts of elm trees infected by one of the wilt-producing fungi and liberal manuring and watering of the trees is urged. So far *Verticillium* was found to be the only parasite, apart from the root fungi, causing definite wilt in maples, and its presence is almost always indicated by the appearance of dark green streaks in the wood. *Sphaeropsis* canker of elm [cf. ibid., xi, p. 212] was quite abundant in Wisconsin but rare in Michigan; *Nectria* canker was more common than any other canker disease except that due to *Cytospora*, which was prevalent, particularly on poplar [cf. ibid., xiii, p. 411] and willow [ibid., xvii, p. 567, 654]. Chestnut blight [*Endothia parasitica*: ibid., xvii, p. 355] was observed to be spreading westwards, killing American chestnuts planted west and north of the native range of this

tree. Blighted trees should be cut down and burned as soon as possible, but in the case of other tree cankers individual surgical treatment is advised on street and park trees and cutting down and burning of affected trees in forest and wooded areas.

TROTTER (A.). **Ricerche intorno agli ammuffimenti e ad altre alterazioni delle Castagne.** [Researches on moulds and other spoilage of Chestnuts.]—*Ric. Ossvz. Divulg. fitopat. Campania ed Mezzogiorno* (*Portici*), vii, pp. 1–40, 2 pl. (1 col.), 14 figs., 1938.

In this paper the author discusses very fully the different types of spoilage affecting Italian chestnuts destined for export to America [*R.A.M.*, xvii, p. 356] and gives full details of three years' investigations carried out in the laboratory, storehouses, and shops in Italy into the different types of injury (insects, external and internal moulds, and fermentative processes set up by bacteria and Blastomycetes).

The kind of internal moulding found in chestnuts is apt to vary from year to year with environmental conditions, though *Penicillium crustaceum* is the chief agent of internal mould every year. In 1934, internal mould due to *Rhacodiella castaneae* [ibid., xv, p. 616] and *Trichothecium roseum* [ibid., x, p. 697] was abundantly present in the chestnuts examined, whereas in 1935 neither fungus was found. In 1936 the former was again widely prevalent, affecting about 10 per cent. of the chestnuts examined, but the chief cause of mould (even in nuts on the trees) was *P. crustaceum*. Disinfection with 'cloramina' and 'euclorina' [loc. cit.] gave excellent results, especially at a concentration of 1 in 10,000, but freedom from spoilage in exported nuts depends primarily on the careful selection of sound clean nuts in the first place.

CRISTINZIO (M.). **Il male dell' inchiostro del Castagno nella Campania.** [Chestnut ink disease in Campania.]—*Ric. Ossvz. Divulg. fitopat. Campania ed Mezzogiorno* (*Portici*), vii, pp. 64–71, 2 pl., 1938.

The author records the presence of chestnut ink disease (*Phytophthora cambivora*) [*R.A.M.*, xviii, p. 70] in several different localities in the province of Campania, where the disease had not been observed until recently, but where, in the last few years, production has progressively declined as a result of infection. The only method of control likely to give satisfactory results lies in replacing the old varieties by the Japanese chestnut (*Castanea crenata*). The regions worst affected in Italy are Tuscany, Piedmont, Lazio, and Liguria. In many districts of the Campania and also in Avellino, infection of chestnuts by *Sphaerella* [*Mycosphaerella*] *maculiformis* [ibid., ix, p. 204], favoured by the prevailing weather conditions, reached epidemic proportions in 1937. A few trees in the Campania were attacked by *Coryneum perniciosum* [ibid., vi, p. 6].

JENKINS (ANNA E.). **An early occurrence of Taphrina sacchari in Wisconsin.**—*Mycologia*, xxx, 6, pp. 689–691, 1 fig., 1938.

The author states that in the Herbarium of the University of Wisconsin she recently discovered a specimen labelled *Gloeosporium*

saccharinum, which is identical in appearance with *Taphrina sacchari* [*R.A.M.*, xviii, p. 71]. This specimen is dated June, 1904, and was collected at Madison, Wisconsin. It is the earliest collection of this fungus yet known, and the only record from Wisconsin.

Blaisdell (Dorothy J.). **Decay of hardwoods by Ustulina vulgaris and other Ascomycetes.**—Abs. in *Phytopathology*, xxix, 1, p. 2, 1939.

Of recent years *Ustulina vulgaris* [*R.A.M.*, xviii, p. 1] has repeatedly been isolated from butt rot of hardwoods in the United States. When grown on autoclaved and hot water-dipped sapwood blocks of green sugar maple [*Acer saccharinum*], beech, and black oak [*Quercus nigra*] in Kolle flasks at room temperature, the fungus from maple was found to have caused after six months a loss of 18 per cent. oven-dry weight in beech, 11 per cent. in maple, and 26 per cent. in black oak. The typical white rot with black zone lines was induced. Considerable decay was further caused under similar conditions by *Xylaria polymorpha* [ibid., xvii, p. 357], *X. fusca*, *Daldinia concentrica* [ibid., xiv, p. 494], *Nummularia atropunctata*, *Hypoxylon* sp., and *Strumella corynoidea* [ibid., xviii, p. 280]. The inoculation of living oak with *U. vulgaris* resulted in typical decay of the heartwood in about a year.

Bondartzeff (A. S.) & Lyubarski (L. V.). Гниль Монгольского Дуба, вызванная трутовиком **Polyporus (Spongipellis) litschaueri (Lohw.) A. Bond.** [Decay of Mongolian Oak caused by *Polyporus* (*Spongipellis*) *litschaueri* (Lohw.) A. Bond.]—*Sovetsk. Bot., 1938*, 3, pp. 121–125, 2 figs., 1938.

The authors state that careful re-examination of the herbarium material at the Botanical Institute of the Academy of Sciences, Leningrad, on which Bresadola based his identification of the three species *Polyporus obtusus*, *P. unicolor*, and *P. schulzeri* with one another, showed that this material consists of three morphologically distinct species [the characters of which are tabulated]. The binomials *P. schulzeri* and *P.* [*Daedalea*] *unicolor* [see above, p. 335] are maintained for two of these forms, but the third is identical with Lohwag's description from Austria of *Spongipellis litschaueri* (*Arch. Protistenk.*, lxxv, 3, pp. 297–312, 1931). To judge from the herbarium material studied, this fungus is the only one of the three species that has so far been recorded in the U.S.S.R. In European Russia its sporophores are occasionally found on living broad-leaved trees, chiefly the oak, elm, maple [*Acer*], and poplar in the Ukraine, certain central provinces, and north Caucasus, and on account of their great variability in size, shape, appearance, and certain morphological details, Bondartzeff transfers the fungus to the genus *Polyporus* as *P. litschaueri* n. comb. [with a revised Russian diagnosis: cf. *R.A.M.*, xv, p. 63]. In the Russian Far East it is common on the Japanese elm (*Ulmus propinqua*) and causes very considerable damage to the Mongolian oak (*Quercus mongolica*), affecting from 61·3 to 89·9 per cent. of the trees in certain districts. On this host it produces a white heart rot, frequently extending throughout the trunk and rendering the timber useless for industrial purposes.

Fréquence du champignon provoquant la pourriture 'rouge tendre' du Sapin dans le canton de Rhodes extérieures. [Incidence of the fungus causing 'pale red' rot of Firs in the canton of Outer Rhodes.]—*J. for. suisse*, xc, 1, pp. 15–16, 1939.

It is stated in the report on silvicultural administration in the demi-canton of Outer Rhodes (Appenzell) for 1937–8 that pale red rot (*Trametes radiciperda*) [*Fomes annosus*] is most prevalent among firs [*Abies*] in light, sandy sites with a south-west exposure, and in damp localities, especially where livestock frequent the plantations and damage the aerial roots. In pure stands the incidence of infection may amount to 50 per cent., whereas in mixed plantings, especially with hardwoods, the disease is negligible or absent, the same being true of populations arising spontaneously from seed. Infection commences to appear on trees of 15 to 20 years old.

ROHMEDER (E.). **Wundschutz an verletzten Fichten.** [Wound protection on injured Spruces.]—*Forstwiss. Zbl.*, lxi, 1, pp. 17–27, 3 figs., 1939.

A detailed account is given of a series of experiments carried out at Grafrath, Bavaria, from 1936 to 1938 to determine the value of various preservatives in the protection of 53-year-old spruces, injured in felling, transport, or in other ways, against the entry of wound fungi, and to settle certain points in connexion with the time and method of treatment. It was found that the ingress of such organisms, which included *Stereum sanguinolentum* [*R.A.M.*, xviii, p. 75] and a species of *Lenzites*, could be largely prevented by the application, as soon as possible after the infliction of the damage, of deacidified mineral coal tar or a proprietary tar-like substance (Farbenindustrie) not yet on the market.

GÄUMANN (E.). **Der Einfluss der Fällungszeit auf die Dauerhaftigkeit des Fichten-, Tannen- und Buchenholzes.** [The influence of the felling time on the durability of Spruce, Fir, and Beech wood.]—Reprinted from *Schweiz. Z. Forstw.*, lxxxix, 7–8, 21 pp., 16 graphs, 1938.

This is a résumé of the writer's studies on the influence of the period of felling on fungal decay of spruce, fir [*Abies*], and beech woods in Switzerland, notices of which have already appeared from other sources [*R.A.M.*, xvii, p. 426].

TEN HOUTEN (J. G.). **Kiemplantenziekten van coniferen.** [Conifer seedling diseases.]—Thesis, Univ. of Utrecht, 125 pp., 5 pl., 1 fig., 1939. [English summary.]

This comprehensive, fully tabulated study of conifer seedling diseases, which are stated to be responsible for heavy losses (up to more than 60 per cent.) in Dutch nurseries, opens with a description of the different types of damping-off as defined by C. Hartley (*Bull. U.S. Dep. Agric.* 934, 1921), followed by a résumé of the pertinent European and American literature.

Inoculation experiments were carried out by van Luijk's method [*R.A.M.*, xviii, p. 47] with a number of the fungi isolated from diseased seedlings on Scots and Austrian pines (*Pinus sylvestris* and *P. nigra* var. *austriaca*). The seeds, sterilized by half-an-hour's immersion in 0·25 per cent. ceresan, were grown in glass tubes on (*a*) Knop's nutrient solution and (*b*) autoclaved soil. The most destructive pathogens,

causing up to 100 per cent. losses, were found to be *Rhizoctonia* [*Corticium*] *solani* from *P. sylvestris* and *P. nigra* var. *austriaca*, *Pythium de Baryanum* from *P. sylvestris*, *Fusarium oxysporum* from *P. sylvestris*, *P. nigra* var. *austriaca*, and *Abies grandis*, *F. solani* from *P. sylvestris*, *P. nigra* var. *austriaca* (including seed), and *Pseudotsuga douglasii* [*P. taxifolia*], *F. scirpi* from *Pinus nigra* var. *austriaca*, *F. orthoceras* from *Pseudotsuga taxifolia*, *Cylindrocarpon didymum* [ibid., xvi, pp. 504, 513], *C. radicicola* [ibid., xvii, p. 116; xviii, p. 154], and *Coniothyrium pityophilum* from *Pinus sylvestris* and *P. nigra* var. *austriaca*, *Naemosphaera rostellata* from *P. sylvestris*, *Botrytis cinerea* from *P. sylvestris*, *P. nigra* var. *austriaca*, *Larix leptolepis*, *Pseudotsuga taxifolia*, and *A. grandis*, and *Botryodiplodia theobromae* from *Pinus merkusii* seed. A moderate degree of pathogenicity was further demonstrated in trials with *Pythium* (?) *torulosum* [ibid., xiv, p. 240] from *Pinus sylvestris* and *A. grandis*, *Gliocladium penicillioides* [ibid., xv, p. 823] from *P. nigra* var. *austriaca*, *Leptothyrium* sp. from *Larix leptolepis*, *Phoma dunorum* n.sp. and *Pleospora herbarum* from *Pinus nigra* var. *austriaca*, *Alternaria tenuis* from *P. nigra* var. *austriaca*, *P. sylvestris* (seed), *L. leptolepis*, and *Pseudotsuga taxifolia*, *Stemphylium asperulum* from *P. nigra* var. *austriaca*, and *Trichoderma lignorum* from *P. sylvestris*, *P. nigra* var. *austriaca* (including seed in both species), *L. leptolepis*, and *Abies grandis* (parasitic in autoclaved forest soil only) [ibid., xvii, pp. 172, 455, 623, 838; xviii, p. 193].

Phoma dunorum [with a Latin diagnosis] is characterized by obtusely conoid, often concrescent, uni- to pluriostiolate, brownish-grey pycnidia, 0·28 by 0·22 mm., and ovoid, obtuse spores, 3·7 to 4 by 2 to 2·3 μ. *Phytophthora fagi* [ibid., xiii, p. 605], included in the tests as an established agent of damping-off though not found in Holland on diseased conifers, proved to be mildly pathogenic. *Pythium artotrogus* [ibid., xi, pp. 91, 331] was very weakly parasitic on *Pseudotsuga taxifolia* and *Pinus nigra* var. *austriaca* but failed to infect *P. sylvestris*. Generally speaking, the more virulent fungi were isolated from the root system and the less severely infectious from the cotyledons and stems.

In some cases the medium on which the fungi were grown before their introduction into the soil exerted a considerable influence on their pathogenicity, presumably by stimulating the production of toxins. For instance, cultures of *F. oxysporum*, *Corticium solani*, and *T. lignorum* from malt salep agar were much more active in this respect than those from Knop's solution, whereas *Pythium de Baryanum* proved to be virtually independent of its substratum. *C. solani* caused much heavier losses to *Pinus austriaca* var. *nigra* seedlings on garden, heath, dune, and loess soils than on acid (P_H 4·5) pine forest soils, in which the damage was practically negligible. Similar results were obtained with *Pythium de Baryanum*. *T. lignorum* was shown to inhibit the parasitic development of *F. oxysporum* and to some extent also that of *C. solani* in sterilized forest soil in pot experiments.

Data regarding the relation of sowing time to the incidence of damping-off were obtained by K. Vik's method (*Landbouwk. Tijdschr., Wageningen*, xlvii, p. 570, 1935), involving the use of 9 or 25 plots, each 80×80 cm., arranged in a square. The best results with *Pinus nigra* var. *austriaca* were given by the March and April (1938) sowings, in

which the numbers of seedlings lost through damping-off on 23rd September were 387 and 133, respectively, compared with 479, 524, and 543, respectively, for the December, January, and February sowings. The same method was used for experiments in the control of the disease on *P. nigra* var. *austriaca* and *Pseudotsuga taxifolia* by various soil treatments, of which covering the seeds with heath sand and gravel was most effective in the case of the former (66 seedlings lost through damping-off after five months compared with 108, 168, 701, and 352 in the controls and plots treated in three other ways, respectively), whereas the latter responded more favourably to 1 per cent. sulphuric acid treatment of the beds at the rate of 5 l. per sq. m. (995 healthy seedlings compared with 623, 504, 198, and 956 for the controls, mixing with heath sand, growing the beds with 5 cm. heath sand, and covering the seeds with heath sand and gravel, respectively). Preliminary trials in the control of damping-off by dusting with red copper oxide (25 to 50 gm. per kg. seed) also gave promising results.

MARTIN (J. F.). **Some economic aspects of White Pine blister rust control.**—*J. For.*, xxvi, 10, pp. 986–996, 2 figs., 1 graph, 1938.

The author gives an historical account of the control of the blister rust (*Cronartium ribicola*) [*R.A.M.*, xviii, p. 216] of northern and western white and sugar pines (*Pinus strobus*, *P. monticola*, and *P. lambertiana*, respectively) in the United States. The control area covers an aggregate surface of some 30,000,000 acres, over 20,000,000 of which (67 per cent.) had been initially cleared of *Ribes* by the end of 1937. The methods of eradication are briefly described, including a chemical method which involves cutting off the bushes at or below soil-level with a Pulaski or long-handled pruning shears and the application of chemicals to the crown, 2 to 3 fluid oz. Diesel oil or saturated ammonium thiocyanate giving the best results on *R. roezli* on dry soil, while $\frac{1}{4}$ to 2 oz. dry ammonium thiocyanate or 1 to 2 oz. sodium chlorate-borax mixture (1:5) have proved effective on *R. viscosissimum*, growing on relatively moist ground in Idaho. Mechanical methods are also in use in the western States, principally represented by the 'bulldozer', a caterpillar tractor fitted with a steel rake to clear the land of mixed *Ribes* and brush.

The efficacy of *Ribes* extirpation as a control measure was demonstrated in 1934 in protected areas in New Hampshire, New York, Vermont, and Pennsylvania, where only 2·2 per cent. of the total contracted infection for the first time after the work of suppression was performed from 4 to 11 years previously, whereas the corresponding figure for unprotected areas was 39·8 per cent. Numerous other statistics relating to various phases of the campaign are cited, and information is also presented on the methods of surveying the stands for the determination of their value prior to the application of control measures, and on the ecological factors to be considered in the work of *Ribes* eradication.

TOOLE (E. R.). **Relation of incidence of needle disease in Loblolly Pine plantations to certain physical properties of the soil.**—*J. For.*, xxxvii, 1, pp. 13–18, 1939.

A significant difference in the amount of infection by needle diseases

(*Septoria acicola* and *Lophodermium pinastri*) [*R.A.M.*, xvi, p. 218; xvii, pp. 196, 214, 567] was observed in 30 loblolly pine ((*Pinus taeda*) plantations of various ages in the 1931 to 1937 groups in a preliminary analytical study in the Duke Forest [North Carolina]. Infection was most severe in the youngest plantings (two to three years old), but no correlation was observed between the amount of disease and height growth or the seven physical properties of the soil investigated.

DAVIDSON (R. W.), CAMPBELL (W. A.), & BLAISDELL (DOROTHY J.). **Differentiation of wood-decaying fungi by their reaction on gallic or tannic acid medium.**—*J. agric. Res.*, lvii, 9, pp. 683–695, 3 figs., 1938.

An account is given of investigations in which the authors tested for oxidases by Bavendamm's gallic or tannic acid method [*R.A.M.*, viii, p. 281; xvii, p. 424; xviii, p. 284] 210 species of wood-decaying fungi, representing several families and numerous genera, mostly of the Hymenomycetes. The results showed that 156, or 96 per cent., of the species associated with white rots gave positive reactions, as well as nine fungi, the rots caused by which were not known. *Stereum subpileatum*, associated with a white pocket rot similar to that caused by *S. frustulosum* [ibid., xviii, p. 275], for the most part reacted positively on gallic acid but negatively on tannic acid media, the reverse being true of *Schizophyllum commune*, a white rot fungus, which grew well on both kinds of media. With the white rot fungi considerable variations were observed in the intensity of reaction and in the time required for the reaction to occur. Of the species associated with brown carbonizing rots 29 (or 80 per cent.) gave no reaction on either medium. Negative reactions were also given by *Fistulina hepatica* associated with a dark, firm rot, *Stereum frustulosum* with a white pocket rot, and *Polyporus dichrous* with a white rot.

The differences observed in the growth behaviour of the different species on gallic acid and tannic acid media are considered to be of value in the identification of the fungi in culture, and a description is given of ten different growth and reaction groups, the species tested being listed under these groups.

BAVENDAMM (W.) & REICHELT (H.). **Die Abhängigkeit des Wachstums holzzersetzender Pilze vom Wassergehalt des Nährsubstrates.** [The dependence of the growth of wood-decomposing fungi on the water content of the nutrient medium.]—*Arch. Mikrobiol.*, ix, 5, pp. 486–544, 1 diag., 11 graphs, 1938.

In a highly technical study at the Tharandt [Saxony] Institute of Forest Botany on the moisture requirements of twelve wood-destroying fungi, three groups were differentiated, viz., (1) *Merulius lacrymans*, *Ceratostomella piceae*, *Lenzites sepiaria*, and *L. abietina* [*R.A.M.*, xvii, p. 496], exacting a very high degree of atmospheric humidity (98·2 or 99 per cent. relative vapour tension on malt agar); (2) *Poria vaporaria*, *Trametes radiciperda* [*Fomes annosus*], *Coniophora cerebella* [*C. puteana*] *Pholiota squarrosa* [ibid., xvii, p. 755], and *Clitocybe* [*Armillaria*] *mellea*, with optima ranging from 95·4 to 99, 96·5 to 99, 95·4 to 98·2, 96·5 to 99, and 90·4 to 99 per cent., respectively; and (3) *Stereum pur-*

pureum, *F. fomentarius* [ibid., xviii, p. 215], and *S. frustulosum* [see preceding abstract], the relatively low corresponding figures for which are 96·5, 95·4, and 90·4 to 96·5 per cent., respectively. The last-named organism, a parasite of oak heartwood, is in fact definitely xerophile, being capable of growth at a relative vapour tension below 85·6 per cent. and actually developing slowly at 81·5. Liability to fungal infection may thus commence at a minimum water content of the wood of 15 per cent., or below fibre saturation point. Analogous results were obtained on sawdust or wood blocks of the appropriate hosts of the several fungi concerned.

The practical application of these data is fully discussed.

FINDLAY (W. P. K.). **Decay of timber and its prevention.**—*Dep. sci. indus. Res., For. Prod. Res. Rec.* (Mycol. Ser. 3), 27, 15 pp., 5 pl., 1938.

After a brief account of the nature of fungi, the conditions influencing fungal growth, and the processes involved in the decay of timber, the author describes the effects of decay on the properties of wood, including discoloration, loss of strength, loss of weight, change of smell, increased absorption of water, the burning properties of decayed wood, increased acidity of the aqueous extract, and susceptibility to attack by boring insects. This section is followed by a discussion of the means of preventing decay in stored timber. Logs from trees highly susceptible to decay should be treated with a preservative as soon as possible after felling if they are not to be removed from the forest at once. Freshly sawn timber may be steamed for a few hours at 200° F., and sawn timbers must be stacked so that the surface at least will rapidly dry. Piles should be erected on brick or concrete piers. Timber in contact with the ground must be creosoted, and all timber-yards kept free from damp, weeds, grass, and decaying wood waste. Timber in service which cannot be kept permanently dry should be treated with a preservative, and valuable woodwork, if decayed, should be exposed for a short time to heat at high humidity in a drying kiln.

CARTWRIGHT (K. ST. G.) & FINDLAY (W. P. K.) **Principal decays of softwoods used in Great Britain.**—106 pp., 16 pl., 5 figs., London, H.M. Stationery Office, 1938 [issued 1939]. 2*s*. 6*d*.

Descriptions are given of the gross and cultural characters, economic importance, and control of the principal fungal rots of standing and felled conifer wood in Great Britain, together with keys for the identification of the chief forms of decay and of cultures of fungi commonly found on coniferous timber. The fungi dealt with include *Armillaria mellea*, *Fomes annosus*, *F. pinicola* [*R.A.M.*, xviii, p. 144], *Polyporus schweinitzii*, *Stereum sanguinolentum*, *Trametes* [*F.*] *pini*, *F. officinalis*, *F. demidoffii*, and *P. sulphureus*, all causing rots of standing conifers; *Peniophora gigantea* [ibid., xvi, p. 429] *Polystictus abietinus*, *Lentinus lepideus*, *Lenzites sepiaria*, *L. abietina*, white species of *Polyporus* (*Leptoporus* section), and *T. serialis*, causing rots of felled softwoods and softwoods in service in the open; the following minor rots of felled softwoods: *Lenzites trabea*, *F. roseus* [ibid., xvii, p. 363], *T. carnea*, *Polyporus benzoinus* [ibid., xviii, p. 215] and *P. borealis*; and the follow-

ing decays of softwoods in buildings: *Merulius lacrymans*, *Poria vaillantii* [ibid., xviii, p. 285], *Coniophora cerebella* [*C. puteana*], *Paxillus panuoides*, and *Poria xantha*. The work concludes with notes on different types of staining, and there is a comprehensive bibliography.

GOIDÀNICH (G.), BORZINI (G.), MEZZETTI (A.), & VIVANI (W.). **Ricerche sulle alterazioni e sulla conservazione della pasta di legno destinata alla fabbricazione della carta eseguite nella R. Stazione di Patologia Vegetale di Roma.** [Researches on the staining and preservation of wood pulp destined for paper-making carried out at the Royal Station of Plant Pathology, Rome.]—513 pp., 3 col. pl., 105 figs., 31 graphs, 1 map, Rome, Tipografia del Senato del Dott. G. Bardi, 1938. [French, English, and German summaries]. 50 lire.

In this exhaustive treatise the authors describe in detail a comprehensive series of investigations carried out in Italy under the auspices of the Ente Nazionale per la Cellulosa e per la Carta into the staining of stored wood pulp destined for paper-making [cf. *R.A.M.*, xviii, p. 220].

The introduction and Chapter I (by Goidànich) discuss the general scope of the problem, earlier work in various countries, and the production of wood pulp (mainly from poplar) in Italy. Chapter II, describing the fungi isolated, is reprinted from Goidànich's earlier paper [ibid., xvii, p. 558]. The third chapter (by Mezzetti) deals with the bacteria found, the staining ability of which was much below that of the fungi.

Chapter IV (by Goidànich and Vivani) describes 33 different types of staining observed, arranged in order of injuriousness, together with the staining abilities of the fungi concerned. A list is given of 38 staining fungi arranged also in order of their injuriousness, the most harmful being *Haplosporella vivanii* and *Phialospora richardsiae* followed by *Hormodendrum elatum*, *H. chamaeleon*, *Stachybotrys alternans*, and *Alternaria tenuis*. The stains produced in nature differed from those developed as a result of artificial inoculations, largely because under natural conditions several different fungi mutually affecting one another are generally concerned in the staining, and also because the environmental factors are very different under the two sets of conditions. The microscopic characters of the stains were not of great value in identifying the organisms responsible. A study of the ability of ten fungi to modify the physical and physico-mechanical properties of the pulp showed that the most injurious in this respect was *P. richardsiae* followed by *Fusarium sambucinum*, and then by sterile fungus no. 193.

Chapter V (by Goidànich and Vivani) describes the physiological and biological characters of the fungi. The effect of heat was determined on the growth of 19 fungi in culture, and the data obtained showed that under the climatic conditions prevailing in Italy, the temperature existing in all but the superficial layers of wood pulp is invariably found favourable to fungal growth. In tests with ten fungi on wood pulp containing from 100 to 400 per cent. moisture a slight diminution of growth was observed at the extremes only. From studies on the effect on fungal growth of the chief nutrient material present in wood pulp, it would appear that destruction of cellulose by staining

fungi is, as a rule, unimportant. The sugars most favourable to fungal growth were glucose, levulose, and maltose. Of the nitrogenous materials present, sodium nitrate was most, and ammonium nitrate least, favourable to fungal growth. Tannins appeared to have an adverse effect on the fungi only when present in unusually large quantities; their presence appeared to make the staining darker and more conspicuous. Other experiments showed that an acid reaction in the pulp, if not too marked, favours fungal growth. Examination of the effect of environmental factors on staining ability demonstrated that heat was directly responsible for bringing about certain staining effects, humidity and availability of air favoured oxidation and the spreading ability of the pigments, changes in the P_H value of the pulp caused marked changes in the colour of the staining, and pigment formation was markedly affected by the chemical composition of the pulp.

In Chapter VI, Goidànich, Mezzetti, and Vivani deal with the etiology and epidemiology of the staining. It was established that when the pulp emerges from the machines it contains few or no fungi, that fungi are abundantly present in the air, but are seldom found in clean water; during processing, however, the pulp becomes progressively more infected, owing to the deposition of spores from the air, and the filtering effect of the pulp during drying [cf. ibid., xvi, p. 575]. Yeasts and bacteria are abundantly present in the pulp when it emerges from the machines, the chief source of these organisms being the wood; they are only sparsely present in the air and in clean water. The quantities of bacteria and yeasts present in the pulp vary widely during the different processes. Bleaching the pulp with sodium bisulphite increases susceptibility to attack by staining fungi, though the effect of the chemical is initially unfavourable to them.

Chapter VII (by Borzini) describes the effect of a large number of antiseptics on the growth of the staining organisms in culture, and Chapter VIII (by Borzini and Vivani) describes practical trials carried out in paper mills with the most promising of these materials. After seven months' storage the best results were given by borax (in the proportion of at least 1 per cent. by weight of the fresh pulp), sodium fluoride (0·5 per cent.), and zinc chloride (0·9 per cent.). Salicylic acid increased the staining.

In the final chapter Goidànich indicates the ways in which the results obtained may be of service to the industry in Italy. [A note on this work appears in *Boll. Sez. ital. Soc. int. Microbiol.*, x, 9, pp. 196–198, 1938.]

Cause and prevention of blue stain in wood.—*Tech. Notes For. Prod. Lab., Wis.*, 225, 4 pp., 1938. [Mimeographed.]

The occurrence of blue stain [*R.A.M.*, xvii, p. 150] in hardwood logs can be effectively retarded for storage periods of up to three months (in the absence of heavy insect infestation) by spraying the ends and barked areas of the freshly cut logs with a 5 per cent. solution of dowicide H [ibid., xvi, p. 579] (sodium tetrachlorophenolate plus excess alkali), santobrite, or dowicide G (both being sodium pentachlorophenolate plus excess alkali), or a 2 per cent. solution of lignasan (ethyl mercuric chloride plus inerts) [ibid., xvii, p. 150]. The same treatments

are suitable also for softwood logs, though the protection given may be of shorter duration.

The most effective means of preventing blue stain in lumber is to kiln-dry the stock when green from the saw. Stock requiring to be air-seasoned can be protected by treating the surfaces with a fungicide or by using a piling method (such as end-racking or crib-piling) that results in a rapid drying; the former method is the cheaper and more effective. The chemical treatment of lumber to prevent staining during air-seasoning usually consists in dipping in dowicide G, dowicide P (sodium tetrachlorophenolate+sodium 2-chloro-o-phenylphenolate+excess alkali), lignasan, and santobrite (all effective for both softwoods and hardwoods), dowicide H (used chiefly with hardwoods), or soda (sodium carbonate and sodium bicarbonate singly or mixed), this last material being used for softwoods at a rate of at least 60 lb. per 100 galls. water at about 160° F. To secure satisfactory results with any dipping or spraying treatment the logs must be free from stain at the time of treatment, no delay must occur between sawing and treatment, and coverage must be thorough.

Wood preservatives.—12 pp., Madison, Wis., U.S., Dep. Agric., For. Prod. Lab., 1938. [Mimeographed.]

Notes are given on a number of wood preservatives widely used in the United States [*R.A.M.*, xvii, p. 641].

Testing wood preservatives.—12 pp., Madison, Wis., U.S. Dep. Agric., For. Prod. Lab., 1938. [Mimeographed.]

In the preliminary section of this paper it is pointed out that there are at present no laboratory tests by which the relative effectiveness of different wood preservatives [see preceding abstract] can be determined with complete reliability. The qualities required in a good timber preservative are discussed, and it is shown how a great deal of useful information can be obtained by laboratory tests on toxicity, penetrating properties, corrosiveness, painting properties, colour, odour, fire resistance, fire and explosion hazard, water repellence and swelling, volatility, leachability, and chemical stability.

Tompkins (C. M.), Gardner (M. W.), & Thomas (H. R.). **Black ring, a virus disease of Cabbage and other crucifers.**—*J. agric. Res.*, lvii, 12, pp. 929–943, 6 figs., 1938 [issued February, 1939].

A condensed version of this paper has already been noticed from another source [*R.A.M.*, xvii, p. 151].

Dalgliesh (C. S.). **Brown-heart in Swedes. Trials with application of borax.**—*N.Z.J. Agric.*, lvii, 6, pp. 511–513, 3 figs., 1938.

During 1937 further trials in the control of brown heart of swedes were conducted in New Zealand [*R.A.M.*, xvi, pp. 82, 360, 649; xvii, p. 152], in which borax at the rate of 10, 15, 20, and 30 lb. per acre was broadcast on the land previous to sowing. Complete control of brown heart was secured with 10 lb. per acre, but no harmful effects on seed germination were produced by applications of 30 lb. per acre, all treated areas showing fresher foliage than the untreated. An applica-

tion of 15 lb. borax per acre gave an average increased yield of $5\frac{1}{2}$ tons. The broadcasting of borax before sowing, taking care that the seed does not come into close contact with the borax, is considered a safe method of control of brown heart, whereas dressings of lime immediately before sowing or the use of fertilizer mixtures containing borax and free lime are not recommended, the first being incompatible with brown heart control, and the second having harmful effects on seed germination. The mixing of borax at the rate of 8 lb. per acre with 2 cwt. of fertilizer applied to the land a few days before sowing, the seed being sown with 1 cwt. or more of fertilizer, is described as a successful measure, which has been adopted as a farming practice in the Rotorua-Putaruru district with good results.

Böning (K.). **Die wichtigsten Krankheiten und Schädlinge des Meerrettichs.** [The most important diseases and pests of Horse-radish.]—*Nachr. SchädlBekämpf., Leverkusen*, xiii, 2, pp. 62–87, 27 figs., 1938. [English, French, and Spanish summaries on pp. 94–95, 97, and 99–100.]

In addition to the horse-radish diseases in Germany discussed in the author's previous paper [*R.A.M.*, xvi, p. 360], notes are given on the relatively unimportant foliar disorders caused by *Alternaria brassicae*, *Ramularia armoraciae* [ibid., iv, pp. 191, 397], *Septoria armoraciae*, *Phyllosticta brassicae* [*Phoma lingam*: ibid., iv, p. 210; vii, p. 71], *Ascochyta rusticana* Bub. & Kab., *Botrytis cinerea*, *Erysiphe polygoni*, and mosaic [ibid., xiv, p. 731].

Böning (K.). **Fragen der Anbautechnik und Krankheitsbekämpfung im Meerrettichbau.** [Questions of cultivation technique and disease control in Horse-radish growing.]—*Prakt. Bl. Pflanzenb.* xvi, 9–10, pp. 205–233, 12 figs., 1938.

This further study on horse-radish cultivation in Germany [see preceding abstract] deals with such matters as judicious spacing, times of sowing, and methods of propagation in relation to productivity, and describes the reaction to white rust [white blister: *Cystopus candidus*] and root blackening (*Verticillium armoraciae*) [cf. *R.A.M.*, xvii, p. 10] of some standard varieties tested in different localities. In tests from 1932 to 1935, inclusive, the three chief German sorts, Bavarian, Silesian, and Spreewald, were all highly susceptible to *C. candidus*, whereas considerable resistance was shown by the Hungarian 'sharp' and 'sweet', especially the former, while the Austrian, though heavily attacked, did not succumb to infection as readily as the externally similar Spreewald. In 1937 the Bavarian, Spreewald, Silesian, and Austrian varieties developed, respectively, 30, 59, 47, and 17 per cent. root blackening, the corresponding figure for Hungarian 'sharp' being only 6 per cent.

Chrzanowski (A.). **Fighting Cercospora beticola Sacc. with Bordeaux mixture.**—*Gaz. cukrown.*, lxxxii, pp. 329–335, 385–390, 1938. [Polish. Abs. in *Chem. Abstr.*, xxxiii, 4, p. 1434, 1939.]

The timely application of Bordeaux mixture as a preventive of beet leaf spot (*Cercospora beticola*) in the Warsaw district of Poland increased

the mean root and leaf weights from 324 and 127 to 436 and 337 gm., respectively, and the sugar content from 16·9 to 19·31 per cent., the corresponding figures for late treatments being 366 and 217 gm. and 18·5 per cent., respectively.

WALKER (J. C.), JOLIVETTE (J. P.), & MCLEAN (J. G.). **Internal black spot of canning Beets and its control.**—*Canning Age*, xix, 13, pp. 489–491, 508, 3 figs., 1938.

A detailed, tabulated account is given of experiments at Winneconne, Wisconsin, in 1938 in the control of internal black spot of Detroit Dark Red and Good-for-all garden beets by borax, from which it appears that a dose of 40 lb. per acre will give reasonably good results in most cases, though in certain areas it may be necessary to increase the amount to 60 lb. The disease, which is stated to be causing much damage among canning beets in New York, Michigan, and Oregon, besides Wisconsin, is characterized by the presence between the rings in the thin-walled layers of the root of irregularly sized and shaped, hard or corky, black spots [*R.A.M.*, xvii, p. 718], usually accompanied by foliar distortion (unilateral development, abnormal elongation, and in extreme cases rosetting) and intense reddening. Occasionally either the root or leaf symptoms occur independently, but they are usually closely correlated.

PERSON (L. H.) & EDGERTON (C. W.). **Seed treatment for the control of bacterial blight of Beans.**—Abs. in *Phytopathology*, xxix, 1, p. 19, 1939.

At no time during the past 25 years of testing seed disinfectants [? in Louisiana] for the control of bacterial blight of beans [*Phaseolus vulgaris*] caused by *Bacterium phaseoli* [*R.A.M.*, xv, p. 782] and *Bact. medicaginis* var. *phaseolicola* [ibid., xvi, pp. 85, 151; xvii, p. 720] did dusts prove satisfactory for this purpose, but in the spring of 1938 very favourable results were obtained by 12 to 14 minutes' immersion in a solution of 1 to 500 mercuric chloride in 70 per cent. ethyl alcohol + 2 per cent. acetic acid. Effective control of initial infection on the primary leaves was secured in all three plantings from 7 to 15 seed lots, whereas the untreated material gave rise to numerous severe infection centres. Some reduction of germination is caused by the treatment.

PARRIS (G. K.). **The reactions of introduced Bean varieties to rust (Uromyces phaseoli typica) in Hawaii.**—*Plant Dis. Reptr*, xxii, 21, pp. 424–428, 1938. [Mimeographed.]

Bean [*Phaseolus vulgaris*] rust (*Uromyces phaseoli typica*) [*U. appendiculatus*: *R.A.M.*, xvii, p. 427], first reported from Hawaii in 1918 by C. W. Carpenter, occurred in a severe form in December, 1937, on the widely grown Lualualei variety, rapidly spreading from the original focus of infection on Oahu throughout the Territory. The results of inoculation experiments with uredospore suspensions of the fungus on 41 reputedly resistant horticultural varieties imported from the United States presented so many inconsistencies as to indicate the existence in Hawaii of a race of the rust distinct from races 1 and 2.

FELIX (E. L.). **Early planting, an aid in the control of Onion smut.**—Abs. in *Phytopathology*, xxix, 1, p. 6, 1939.

Early sowing (20th March to 5th April under normal weather conditions) is stated to have effected an appreciable reduction in the incidence of onion smut [*Urocystis cepulae*: *R.A.M.*, xix, p. 82] in the Elba district of New York State. The minimum soil temperatures for onion seed germination and smut growth and infection are about 8° and 10° C., respectively. Prevailing soil temperatures of 8° to 13° during the pre-emergence phase substantially lower the amount of smut, while a maximum of 8° to 10° in the top inch of soil reduces greenhouse and field infection to between 60 and 78 per cent. of that occurring at the optimum of 15° to 20°. Very early planting is recommended as a supplement to the regular formaldehyde treatment, especially in fields with a relatively small amount of infection.

IVANOFF (S. S.). **White rust of Spinach.**—Abs. in *Phytopathology*, xxix, 1, p. 12, 1939.

Heavy losses were caused in southern Texas in 1937–8 by an epidemic of white rust (? *Albugo* [*Cystopus*] *occidentalis*) of spinach, which broke out in December and continued throughout the growing season, leaving no healthy plants in the fields inspected. Symptoms of the disease include the development of scattered white sori mainly on the under sides of the leaves and, under certain conditions, a yellowing and mottling of the foliage. The fungus forms hyaline conidia and in the diseased tissues a profusion of pale to dark brown oospores, with a finely and shallowly reticulate surface, appearing pitted. These organs seem to be identical with those of the white rust attacking *Chenopodium capitatum*. None of the 150 spinach varieties and strains tested for their reaction to *Cystopus occidentalis* proved to be immune, but some degree of resistance was shown in commercial fields by Viroflay in comparison with the widely grown susceptible Bloomsdale Longstanding.

SELARIÈS [P.] & ROHMER [G.]. **La septoriose du Céleri en Alsace.** [Septoriosis of Celeriac in Alsace.]—*Ann. Épiphyt.*, N.S., iv, 3, pp. 485–493, 1 fig., 1938.

Details are given of the authors' study of the control of the celeriac leaf blight (*Septoria apii-graveolentis*) [*R.A.M.*, xviii, p. 291] which is stated to be so prevalent in Alsace as to compromise the cultivation of the crop in that region. Satisfactory disinfection of the seed, with the least injury to its germinability, was obtained by steeping the seed for 30 minutes in 2 per cent. commercial formalin. The seed-beds should be disinfected by watering them with 10 l. of 5 per cent. formalin per sq. m., after which the soil is covered with bags for 48 hours; the surface of the soil is then raked superficially on four or five consecutive days, when it is ready for sowing. It is recommended that the seedlings be sprayed with 1 per cent. Bordeaux mixture at least twice before transplanting. In practice good control of the disease in the field was obtained by spraying the seedlings with 1 per cent. Bordeaux mixture as soon as the first pustules of the blight appeared, followed by a second application of the spray two or three weeks later.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, l, 1, pp. 25–29, 4 figs., 1939.

The measures recommended for the control of anthracnose of cucurbits (*Colletotrichum lagenarium*) [*R.A.M.*, xvii, p. 789] in New South Wales are as follows. Crop rotation should be adopted, and cucurbits grown on the same land only once every three or four years. All diseased material should be burned. Seed must be taken from a clean crop, or treated for five to ten minutes in mercuric chloride (1 in 1,000). Affected vines should not be disturbed while wet. Spray applications of Bordeaux mixture (3–4–40) should be made when the first two or three leaves have developed, shortly after the vines have begun to run, about a week after the first melons have set, and lastly two or three weeks later.

Cook (H. T.) & Nugent (T. J.). **Fusarium wilt resistant Watermelons.**—*Trans. Peninsula hort. Soc.*, xxviii, 5, pp. 30–38, 2 figs., 1938.

In greenhouse soil inoculation experiments at the Virginia Agricultural Experiment Station in 1938, the Hawkesbury watermelon showed a considerable degree of resistance to wilt (*Fusarium*) [*bulbigenum* var. *niveum*: *R.A.M.*, xviii, p. 84] (9·9 to 22·6 per cent. wilted seedlings compared with 52·2, 81·8, and 74·3 per cent. in the Leesburg, Owens Grey, and Tom Watson varieties, respectively). Hawkesbury also gave very satisfactory results in the field, and most of the 18 growers supplied with seed of this variety expressed a favourable opinion of its qualities.

Uppal (B. N.), Patel (M. K.), & Kamat (M. N.). **Bacterial leaf-spot of Soybean in Bombay.**—*J. Univ. Bombay*, vi, 5, pp. 16–18, 1938.

An organism isolated from a leaf spot of soy-bean on the Jalgaon Farm, Bombay, in 1934 is identified on the basis of its morphological and cultural characters as *Phytomonas* [*Bacterium*] *phaseoli* var. *sojense* [*R.A.M.*, xvi, pp. 585, 655].

Amtliche Pflanzenschutzbestimmungen. [Official plant protection regulations.]—*Beil. NachrBl. dtsch. PflSchDienst*, x, 8, pp. 253–256, 1938.

Latvia. Lists are given (30th April, 1938) of (*a*) pests and diseases to be combated in, and as far as possible excluded from, Latvian tree nurseries, and (*b*) dangerous diseases (30 in number including many well-known pathogens) and pests and plants prohibited from importation into the country.

Service and regulatory announcements. July–September, 1938.—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, pp. 88–118, 1938.

Summaries are given of the plant quarantine import restrictions in force in New Zealand (supplementary), French zone of Morocco (revised), Turkey (supplementary), Italy (supplementary), Australia, Colombia (superseding previous regulations), Malaya (superseding previous regulations), and Kenya.

IMPERIAL MYCOLOGICAL INSTITUTE

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SEVERIN (H. H. P.) & FREITAG (J. H.). **Western Celery mosaic.**—*Hilgardia*, xi, 9, pp. 493–558, 8 pl., 9 figs., 1938.

Celery in California is affected by western celery mosaic [*R.A.M.*, xv, p. 191; xviii, pp. 78, 83], celery calico [ibid., xv, p. 191], celery yellow spot, celery crinkle leaf, celery yellows (identical with California aster yellows) [ibid., ix, p. 289], and [tomato] spotted wilt, and has also been experimentally infected by sugar beet curly top and ring spot of poison hemlock [*Conium maculatum*]. Crinkle leaf is characterized by crinkled leaflets with green islands or blister-like elevations, stunting of the young plants, and yellowing of the leaves, frequently followed by death. Yellow spot is proposed as a name for a disease causing small, irregular chlorotic areas on the leaves, yellow stripes along the veins, and frequently white spots on the petioles.

Investigations into western celery mosaic showed that the host range is confined to the Umbelliferae. Varieties of celeriac and carrot were found to be naturally infected, while experimental infections by juice inoculations and by means of aphids gave positive results on Large Smooth Prague celeriac, dill (*Anethum graveolens*), curled chervil (*Anthriscus cerefolium*), caraway (*Carum carvi*), coriander (*Coriandrum sativum*), carrots, and single or plain parsley.

Mechanical inoculations of healthy celery with juice from the leaves of infected carrots gave lower percentages of infection than with juice from the roots. The virus was more readily recovered from parsley by mechanical inoculation (42·9 per cent.) than by *Aphis ferruginea-striata* (5·7 per cent.), these transmissions being secured from parsley plants devoid of symptoms. Mechanical inoculations of cucumber plants with the extract from affected celery collected in 23 localities gave negative results, as did attempts at similar transmission with 11 species of aphids.

The virus is filterable through all grades of Chamberland filters. Its thermal inactivation point is 60° C. in 10-minute exposures, its tolerance to dilution 1 in 4,000, and its resistance to ageing *in vitro* 7 days; the virus in the supernatant liquid withstood treatment with 30 per cent. alcohol for one hour and that in the precipitate 40 per cent. The incubation period is 10 to 16 days or more out-of-doors.

The chief symptoms on small plants in the field are yellowing of the foliage, plant stunting, shortening of the central younger petioles, and

horizontal outer petioles. In cool localities the younger leaves show green and yellow speckling or mottling. As the disease progresses, the older leaves may show rusty or brown, necrotic, sunken areas on the upper surface, while the petioles sometimes display white streaks or spots. The advanced stage is characterized by narrow, twisted, cupped leaflets, the petioles sometimes showing longitudinal white streaks alternating with green ones or, more often, white spots only.

No specific aphid vector was found. Six species not breeding on celery were capable of transmitting the disease, as well as 11 other species (including *A. gossypii*, *A. rumicis*, *Myzus circumflexus*, and *M. persicae*) found breeding on celery, the average percentages of infection produced by the latter varying from 84·8 to 14·1 per cent. The highest percentage of infection by single winged aphids was 7 per cent. (*A. apigraveolens*), and by single wingless mature aphids 37·3 per cent. (*A. ferruginea-striata*). Ten species of aphids transmitted the virus from diseased to healthy celery during the first day, but 56 lots each of 20 aphids lost their infective power by the second. Five lots of 20 individuals of *A. ferruginea-striata* reared on infected celery transmitted the disease to healthy celery plants on which they were fed overnight for 12 hours, but when they were transferred at intervals of an hour during a period of eight hours to successive sets of plants, no infections resulted. Retention of the virus by single infective wingless aphids ranged from one to eight hours, and by lots of 20 infective aphids from one to ten hours. The period required for aphids to recover the virus from infected celery ranged from before the appearance of the first symptoms up to six days after these had developed.

Palo (M. A.). **Eggplant diseases and their control.**—*Philipp. J. Agric.*, ix, 4, pp. 403–414, 7 pl., 1938.

The low production of eggplants in the Philippine Islands is partly due to diseases, which sometimes reduce the yield by 50 to 90 per cent., and in some localities may destroy the whole crop. The diseases most commonly met with are damping-off (due to *Rhizoctonia* [*Corticium*] *solani*, *Phomopsis vexans*, and *Sclerotium rolfsii*), bacterial wilt (*Bacterium solanacearum*) [*R.A.M.*, xv, p. 459; xvii, pp. 300, 303], *Phomopsis* disease (*P. vexans*) [ibid., xvii, p. 375], *Phytophthora* disease (*P. melongenae*), and stem rot (*S. rolfsii*) [ibid., xiv, p. 315]. Leaf spot (*Cercospora melongenae*) [ibid., iii, p. 556; xii, p. 203], rust (*Puccinia tubulosa*) [ibid., xiv, p. 608], and anthracnose (*Gloeosporium melongenae*) [ibid., xv, p. 272] are of minor economic importance. Brief descriptions are given of the various diseases, with directions for their control.

Hewitt (W. B.). **A transmissible disease of Grapevines.**—Abs. in *Phytopathology*, xxix, 1, p. 10, 1939.

During the last five years a disease with symptoms resembling those of the so-called 'California vine disease', described by N. B. Pierce in 1892, has become progressively more destructive in certain parts of California, causing losses of up to 30 per cent. On the Emperor variety the leaves show a dark green veinbanding and puckering of the interveinal tissue; affected vines usually die during the season following the first foliar manifestations of the trouble. The Ribier variety develops

no distinct leaf symptoms, the vines wilting and shrivelling in mid- and late summer, generally with a heavy crop. In the early autumn the foliage of most varieties exhibits necrosis of the margins and interveinal tissues. In late summer some of the vines die back from the tips, and the remaining portions mature only in irregular, dark brown patches. The berries frequently soften or may shrivel. The disorder has been transmitted only by root grafting and budding.

SCHEU (H.). **Die Verschiebung des phänotypischen Bildes einer auf Plasmopara viticola—Widerstandsfähigkeit selektionierten E×A F_2-Population.** [The disorganization of the phenotypic arrangement in an E×A F_2 population selected for resistance to *Plasmopara viticola.*]—*Wein u. Rebe*, xx, 11–12, pp. 340–348, 3 graphs, 1938.

In studies at Müncheberg, Germany, the author analysed the behaviour of the F_2 population of a cross between the European Gamay vine (*Vitis vinifera*) and the American Riparia 595 Oberlin (*V. riparia*), 500 of the plants being selected for resistance to *Plasmopara viticola* [*R.A.M.*, xvii, p. 727] and 500 unselected. Even a superficial morphological examination revealed a difference in the two populations: the selected had more individuals of the European type than the unselected one. The analytical results showed that in this cross the inheritance of resistance to *P. viticola* is to a certain extent correlated with the inheritance of strong acidity, pronounced grassy taste, and a deep red juice, the colour of the juice being also an indicator of acidity. It does not follow, however, that such a correlation will be found in all F_2 generations of crosses between European and American vines. The author thinks that it will probably be easier to obtain a resistant European vine with a European type of taste than an American vine of a similar flavour.

BODE (H. R.). **Beiträge zur Kenntnis der Reisigkrankheit der Rebe.** [Contributions to the knowledge of the 'reisig' disease of the Vine.]—*Gartenbauwiss.*, xii, 4–5, pp. 406–419, 5 figs., 1939.

In continuation of his studies on the 'reisig' disease of the vine in Germany [*R.A.M.*, xvi, p. 795; cf. also ibid., xviii, p. 294], the author states that his observations confirmed the statement by Schneider (Inaug. Diss. Bonn, 1934) that the court-noué phase of the disease only appears from the formation of the sixth internode of the shoots onwards; counts made on 300 affected vine-stocks showed that the condition developed preponderantly in the 8th to the 14th internode. This is considered to show that all the internodes formed inside the dormant buds of diseased stocks during the preceding autumn grow normally and that the development of abnormally short internodes or of double nodes is due to some as yet unknown disturbance in the physiology of the plant during the new season. Low temperatures were shown not to be the determining factor. He states further that when cuttings with only one bud, taken from affected stocks, were grown under favourable conditions, in the first year they produced normal shoots without any sign of court-noué, which reappeared, however, in the second year of growth. Details are then given of microscopic studies of the growing point, the results of which showed that

while normally the nuclear and cell divisions preceding the elongation of an internode primordium occur first on one side of the growth cone and then on the other, the formation of short or double nodes is preceded by nuclear and cell divisions simultaneously on both sides of the cone. It is finally stated that the results of further experiments clearly indicated that the boron deficiency symptoms described by Maier [ibid., xvi, p. 585] are quite distinct from those of court-noué.

KACZMAREK (A.). **Untersuchungen über den Rückgang von Pfropfreben in Neuanlagen des Saale- und Unstrutgebietes.** [Investigations on the dying-out of grafted Vines in new plantations of the Saale and Unstrut region.]—*Gartenbauwiss.*, xii, 4–5, pp. 420–509, 16 figs., 4 diags., 1 graph, 1939.

This is a full account of investigations started in 1928 to ascertain the causes of the high mortality of grafted vines in newly planted vineyards in the Saale and Unstrut region of Germany, which aroused considerable apprehension among the local growers from 1925 to 1930, and is still prevalent in some localities. The results are claimed to have shown conclusively that the trouble is not of parasitic or virus origin. All the evidence collected indicated that it is mainly due to unfavourable environmental, especially soil, conditions, and possibly also to some extent to defective grafting and neglect of the cuttings prior to planting in the field.

FOËX (E.) & CRÉPIN (C.). **Sur quelques maladies et accidents des plantes cultivées en 1938.** [On some diseases and injuries of cultivated plants in 1938.]—*C.R. Acad. Agric. Fr.*, xxv, 3, pp. 131–137, 1939.

During 1938 *Cercosporella herpotrichoides* was more in evidence than *Ophiobolus graminis* as an agent of foot rot in wheat in France [*R.A.M.*, xviii, p. 166], where the authors' observations in Seine-et-Oise and Loiret were confirmed by those of E. Rosella in the eastern Pyrenees. *Fusarium culmorum* was unusually virulent on oats [ibid., xvii, p. 668], causing bleaching and desiccation of the panicles and premature death of the plants. In the plain of Saône and the Rhone Valley cereal crops were severely damaged by the night frosts of April, and in some cases the stem lesions bore an apparently parasitic *Sclerotium*, the symptoms associated with which resembled those described for *S. costantini* [on wheat: ibid., xvi, p. 734].

Potatoes suffered from a characteristic physiological disorder known as 'boulage' [failure], apparently associated with excessive dryness of the soil and resulting in the development of a succession of minute, unmarketable tubers, which give rise to feeble shoots incapable of producing a normal crop. *Rhizoctonia* [*Corticium*] *solani* flourished on potatoes during the dry, cold months of April and May, but Bintjes in one district under observation made a good recovery following heavy rains in early June.

DASTUR (J. F.). **Report of the Mycologist, Central Provinces and Berar, for the year ending the 31st March, 1938.**—*Rep. Dep. Agric. Cent. Prov. Berar, 1938,* pp. 30–32, 1939.

Cotton seed treated before sowing on the Nagpur College Farm with

agrosan G, hortosan B, abavit B, ceresan, copper carbonate, sulphur, or sulphuric acid gave higher yields than the untreated controls. Anthracnose [*Glomerella gossypii*] caused severe infection of cotton in parts of Berar [*R.A.M.*, xvi, p. 232] owing to the high humidity prevailing in October; the Buri and Roseum varieties were virtually free from the disease, but Bani 306, Verum 438, and especially Verum 434 sustained heavy damage.

Head smut of sorghum (*Sorosporium reilianum*) [ibid., xvi, p. 377] was experimentally shown to be a soil-borne disease. Soil in pots inoculated with the fungus a week or a fortnight before sowing gave rise to a higher percentage of smutted plants than that infected at sowing time. Attempts to infect the plants through the growing point or lateral 'eyes' gave negative results. Young sorghum plants were successfully inoculated with *Sphacelotheca sorghi* [loc. cit.] by placing the spores on the growing points or introducing the inoculum into the stem below the growing point by means of a hypodermic syringe.

'Tikka' disease of groundnuts [*Cercospora personata*: ibid., xvi, p. 232] developed late and caused little damage, but much higher yields were obtained from plots sprayed with Bordeaux mixture (especially with linseed oil as a sticker) than in those left untreated.

Mottling or frenching of oranges [ibid., xiv, p. 481] was reported from various localities.

Brown spot of tobacco (*Alternaria longipes*) [ibid., xvii, p. 776] was observed at Ellichpur and Bilaspur.

Noble (R. J.). **Australia: notes on plant diseases recorded in New South Wales for the year ending 30th June, 1938.**—*Int. Bull. Pl. Prot.*, xiii, 2, pp. 25–26, 1939.

Flag smut (*Urocystis tritici*), though still serious on susceptible wheat varieties, is stated to be of less importance than formerly in New South Wales [*R.A.M.*, xiv, p. 25], as resistant varieties are now very widely grown there. Potatoes in coastal areas were affected by brown rot (*Bacterium solanacearum*) and the tomato spotted wilt virus [ibid., xvii, p. 223]; the most common virus disease of this crop locally is leaf roll. Bananas developed a 'rubbery' condition, in which their texture was hard and unpalatable, apparently associated with production in forest areas and low temperatures in the later stages of development. Iceland poppies (*Papaver nudicaule*) were affected by crown rot (*Phytophthora cryptogea*), and violets by scab (*Sphaceloma violae*) [ibid., xiv, p. 764].

Storey (H. H.). **Plant pathology.**—*Rep. E. Afr. agric. Res. Sta., 1st April–31st December, 1937*, pp. 9–13, 1938.

In connexion with breeding work against cassava virus diseases in East Africa the author states that Amani is very suitable for the maintenance of the large number of cassava types now collected, as the infection rate is low and mosaic [*R.A.M.*, xviii, p. 230] is readily controllable by roguing. A testing ground, however, will have to be developed elsewhere. The existence, now confirmed, of different strains of the mosaic virus [loc. cit.] may greatly increase the difficulties of control. Under favourable conditions, the brown streak cassava virus [ibid.,

xvi, p. 87] causes a total loss of the crop, but such conditions are unusual in the areas where the crop is grown, and severe loss has occurred so far only in Amani during the colder months. The disease, however, appears to be as prevalent as mosaic in Zanzibar and the Tanganyika coastal belt, and it certainly plays a part in crop degeneration. It destroys many of the buds, and diseased cuttings frequently fail to shoot.

Arrangements have been made for the spectrographic analysis of clove material, to determine the cause of 'sudden death' [ibid., xvii, p. 626].

ORIAN (G.). **Division of Plant Pathology.**—*Rep. Dep. Agric. Mauritius, 1937*, pp. 35–39, 1939.

Inoculations into sugar-cane leaves and blades with a bacterium isolated from diseased *Thysanolaena maxima* [*T. agrostis* Nees: *R.A.M.*, xvii, p. 67] showed this organism to be identical with *Bacterium vasculorum*. Cross-inoculations with *Bact. vasculorum* and the bacteria from white palm (*Dictyosperma album*) [ibid., xvi, p. 745] and *T. agrostis* on their several hosts and maize further confirmed their identity. In view of the cultural characters of the maize bacterium and of the similarity of the symptoms shown in the bacterial disease of maize reported from Mauritius in 1932 [ibid., xiii, p. 495] and those produced by *Bact. vasculorum* when inoculated into maize, it is now considered that the maize disease recorded in 1932 was also due to *Bact. vasculorum*. Inoculations with isolations from sugar-cane, *D. album*, and *T. agrostis* gave positive results on *Coix lacryma-jobi*, *Panicum maximum*, and a species of giant bamboo (*Dendrocalamus* sp.); the organism was reisolated from the stripes produced on the leaves of the inoculated plants.

In further trials of the resistance of sugar-cane varieties to *Bact. albilineans* [ibid., xvii, p. 97] it was found that D.K. 74, practically immune under field conditions, again showed marked susceptibility to artificial infection through the cuttings, five out of seven stools inoculated showing the disease during the first year of growth.

Tobacco in one field showed symptoms possibly due to potash deficiency [ibid., xvi, p. 412]. In the top leaves the veins were much thickened, and the interveinal tissue was chlorotic or almost white. These leaves were very dwarfed, and the tips curved down. The condition was not transmitted by grafting, and the affected plants recovered when transferred to new soil.

JOHNSTON (C. O.) & BROOKS (T. E.). **Kansas mycological notes, 1937.**—*Trans. Kans. Acad. Sci.*, xli, pp. 121–123, 1938.

The 1937 epidemic of stem rust of wheat [*Puccinia graminis tritici*] is stated to have been one of the most serious ever experienced in Kansas, causing an average loss over the State of 6·6 per cent., representing a reduction in yield of over 10,000,000 bush. Infection appeared in the counties along the Oklahoma line about 20th May and travelled northwards, developing with extreme severity (27 per cent. average loss) in the eastern counties. Other observations on cereal rusts included heavy infection of sweet corn [maize] and teosinte (*Euchlaena mexicana*) by *P. sorghi* [*P. maydis*]. Sorghum rust (*P. purpurea*)

[*R.A.M.*, xv, pp. 635, 683] was detected near Manhattan for the first time for several years. In the same district lucerne rust (*Uromyces striatus*) [ibid., xvii, p. 325] was also prevalent.

Gnomonia ulmea [ibid., xviii, p. 354] was widespread on American elm [*Ulmus americana*] foliage in the east of the State, but caused little damage to the red [*U. rubra* or *U. fulva*] and Chinese [*U. pumila*] species. *Tranzschelia* [*P.*] *pruni-spinosae* was responsible for exceptionally heavy infection of wild black cherry (*Prunus serotina*) [ibid., xviii, p. 322] in a soil-conservation nursery.

Department of Plant Pathology. Plant disease studies.—*Rep. Okla. agric. Exp. Sta., 1936–38*, pp. 135–144, 1939.

During 1938 a destructive outbreak of orange leaf [brown] rust [*Puccinia triticina*] occurred on wheat in Oklahoma. Evidence was obtained that infection of the new crop in the autumn of 1938 was mainly due to spores blown into Oklahoma from the north, and not to spores borne on local stands of volunteer wheat or grasses. Thus the practice, usually recommended for control purposes, of destroying volunteer grain in the fence rows would appear to be of small value. Control must finally depend on the use of resistant varieties.

In experiments with Turkey wheat in 1937–8 grading into small and large seed fractions materially reduced the amount of bunt [*Tilletia caries* and *T. foetens*] in the seed and increased the stand. Infection in the untreated controls amounted to about the average for Oklahoma, and was completely eliminated by seed dusting with ceresan ($\frac{1}{2}$ oz. per bush.) or copper carbonate ($2\frac{1}{2}$ oz. per bush.). Mechanical dusting gave more effective control than stirring the dust into the seed by hand in the drill box.

Laboratory, greenhouse, and field experiments indicated that under Oklahoma conditions ceresan dusting was less effective than delinting and gravity-grading of cotton seed [*R.A.M.*, xviii, p. 105] in increasing stand and yield. The improvement resulting from dusting, however, warrants a trial of this method when equipment is lacking for the acid treatment. In seven out of eight lots of cotton seed from Oklahoma and other States significant increases in stand of from 10 to 70 per cent. were given by ceresan dusting. There was no significant increase in yield, indicating that under the conditions prevailing locally in 1938 the chief advantage of the treatment was that it permitted a lower seeding rate than was possible with untreated seed. Laboratory tests confirmed the finding that cotton seed treated with ceresan regularly produces a higher percentage of healthy seedlings than untreated seed.

[Jensen (J. H.).] **Plant disease investigations.**—*Rep. P.R. agric. Exp. Sta., 1937*, pp. 82–92, 1938.

Bunchy top disease of papaw, hitherto thought to be due to a virus [*R.A.M.*, x, p. 398], is of some economic importance in Puerto Rico as it reduces yields and imparts an unpleasant taste to the fruits produced. Affected plants are severely stunted, produce dwarfed and shortened internodes, and show premature fall of the flowers. Apparently diseased plants sometimes recover, and are often cured by cutting away the diseased top. Attempts to transmit the disease by juice

inoculation (syringe and pin puncture), rubbing healthy leaves with juice from diseased ones, budding and grafting, all gave negative results; but plants from which insects were excluded remained unaffected, whereas unprotected plants from the same lots became diseased.

Sugar-cane leaves affected by chlorosis in Puerto Rico show yellowish-green, yellow, or yellowish-white interveinal areas lying between veinal areas of almost normal green. When the chlorosis is very severe the leaves turn nearly white, and the plants die. Affected leaves recovered their green colour when brushed or sprayed with a solution of ferrous sulphate.

Grapefruit trees moderately affected with mottle leaf [ibid., xviii, p. 308] completely recovered after one spray application of zinc sulphate (7 lb. per 100 gals. water).

Department of Plant Pathology.—*Rep. Del. agric. Exp. Sta., 1937–8* (*Bull.* 214), pp. 29–45, 3 figs., 1938.

The following items, apart from those already noticed from other sources, occur in this report. The data obtained (by T. F. Manns) from budding work with over 200 sources of wild plum from different parts of Delaware showed that only a few carried peach yellows or little peach [*R.A.M.*, xvii, pp. 223, 827]. The only vector of both viruses found was *Macropsis trimaculata*. When the vector was fed on peach trees affected with yellows or little peach and then transferred to healthy Elberta or natural peach seedlings, the amount of infection that developed seldom exceeded 12 per cent., whether 5, 25, or 100 insects were used on each plant. In a few instances infection reached 50 to 75 per cent. in the first season, while in a number of cases the insects failed to transmit little peach. Both wild and cultivated plums breed the vector in much larger numbers than do peaches, while well-cultivated, sprayed peach orchards hardly ever show the insect. A limited number of *M. trimaculata* were found in neglected peach orchards in upper Delaware, but seldom under similar conditions in the lower part of the State.

T. F. Manns selected 35 Marglobe, Rutgers, and Greater Baltimore tomato plants showing partial resistance to early blight (*Macrosporium* [*Alternaria*] *solani*) [ibid., xvii, p. 224] during a severe outbreak of the disease which destroyed 60 per cent. of the crop. Data were obtained indicating that the fungus is wind-borne. A number of plants apparently completely resistant to *A. solani* were found to be infected with mild mosaic.

T. F. Manns, J. W. Heuberger, and S. L. Hopperstead observed that during the severe outbreak of *Bacterium pruni* on peach in 1937 [ibid., xvii, p. 471], the buds on the young trees coming into bearing were so deeply infected that they showed the bacteria in a nutrient agar culture after a surface disinfection with alcoholic mercuric chloride (five parts mercuric chloride in 10,000 of 50 per cent. alcohol) when disinfected for 30 seconds. The percentage of bud infection appeared to fall markedly in winter, and in some instances only 1 to 5 per cent. of the buds were infected in January, February, and March. Dissemination of *Bact. pruni* was general from peach nurseries. Considerable evidence was obtained that the severity of infection is affected by the fertilizers applied. A ten-acre Elberta orchard given chicken manure (2 bush.

per tree) became completely defoliated, and the set of fruit, while abundant, was a complete failure in size and quality.

Итоги научно-исследовательских работ Всесоюзного Института Защиты Растений за **1936** г. Часть III. Вирусные и бактериальные заболевания растений, биометод, химизация и механизация защиты растений. [Summary of the scientific research work of the Institute of Plant Protection for the year 1936. Part III. Virus and bacterial diseases of plants, the biological, the chemical, and the mechanical methods of plant protection.]—111 pp., 2 figs., 5 diags., 3 graphs, Госуд. Издат. колх.-совх. Литер. „Сельхозгиз“ [State Publ. Off. Lit. collect. co-op. Farming 'Selkhozgiz'], Leningrad, 1938.

This collection of papers by various authors [cf. *R.A.M.*, xvii, pp. 433, 438] on virus and bacterial diseases of various crops and on different methods of control contains the following items of interest.

S. M. Mashtakoff (pp. 3–5) reports that under field conditions in south-eastern U.S.S.R., shading potato plants by dusting with fine white clay either throughout the season or at certain intervals reduced the average number of plants showing symptoms of mosaic per plot from 8·4 in the control to 1·4, and spraying with a mixture of either clay or chalk (1 part to 7 of water) plus casein (0·3 per cent.) reduced the number from 12·6 and 10·2 to 2·1 and 5·8, respectively. A serological examination of the treated plants, however, revealed the presence of a masked X virus in most of them, indicating that the screening effect of the dusts and sprays merely weakens the pathogenicity of the virus. The yields of treated plants were from 0 to 56 per cent. higher than of the untreated. Covering the soil with chalk reduced virus infection by 50 per cent., but the yield was only equal to, or even slightly lower than, that of the control. Mulching with straw and simultaneous spraying with chalk or black aniline dye reduced the number of virus-diseased potato plants by 30 and 15 per cent., respectively, and increased the yield by 18 and 64 per cent., respectively.

M. S. Dounin and Mme E. V. Shatova (pp. 6–7) state that in the Moscow district in 1936 from 4·4 to 45 per cent. of black currant plants were found to be affected by reversion [ibid., xvi, p. 822], the nursery which had supplied the seedlings for some of the chief plantations of the district being almost completely infected. The yields of severely reverted plants is reduced to 3·5 per cent. of the normal. Raspberry plantations were found to be severely affected by yellows, mosaic [ibid., xviii, p. 190], streak, leaf roll, leaf curl, and dwarf, the two chief commercial varieties, Usanka and Marlborough, showing from 75 to 100 per cent. and from 20 to 35 per cent. of virus infection, respectively. Reports on the wide distribution of these virus diseases of raspberries have also been received from several other districts of the Soviet Union.

Mme N. N. Popova (pp. 10–12) describes the preliminary results of experiments in which potato leaves infected with rugose mosaic were dried at 25° C., stored for various periods at 20° to 25°, later soaked in distilled or boiled water for two to three hours, and the expressed fluid then tested for the presence of the precipitinogen of the X virus. It appeared from the results obtained that the precipitinogen was

preserved in dried leaves for over three months, and it is concluded, therefore, that dried leaves can be safely used for serological tests by the drop method [ibid., xvii, p. 762].

Mme E. V. Shatova (pp. 12–14) states that X virus sap isolated from rugose mosaic potatoes and purified by means of aluminium hydroxide gel had a higher infectivity at a dilution of 1:10,000, produced symptoms in *Nicotiana glutinosa* earlier, and contained less dry residue than when purified by means of silica gel, kaolin, or specific serum.

The same author in another paper (pp. 14–16) relates that the X and Y viruses received from K. M. Smith from England were found to be more pathogenic and to differ in some respects from the X and Y viruses isolated from potato varieties Lorch and Deodara in U.S.S.R. It was found experimentally that the Russian strain of virus X has the same inactivation point (66° C.) as that recorded by Henderson Smith, but a lower one than that found by Koch and Böhme [cf. ibid., xii, p. 588], while the Russian strain of virus Y has a somewhat higher inactivation point (58°) than that found by Henderson Smith (52°), and seems to resemble the strain studied by Koch, differing from the latter, however, in not inducing veinbanding.

Mme N. N. Popova (pp. 17–20) investigated the conditions under which the anti-virus serum X can be stored without losing its activity. The liquid sera, diluted with physiological solution plus 0·5 per cent. phenol and stored at 25° to 33° C., were still good after one month. The titre of such sera stored at 5° for $5\frac{1}{2}$ months was considerably higher than that of those stored at 25°. Sera dried in drops on glass slides or films of acetyl cellulose lost their activity more quickly than liquid sera, so that they are not recommended for use later than ten days after drying.

D. E. Belenky (pp. 20–22) was able to identify the X-bodies in the sap of *Nicotiana glutinosa* leaves infected with potato virus X by using the Fontana-Tribandeau method of staining. The dried films of the clarified virus-infected sap were fixed with an acetic acid-formalin mixture treated with a hot aqueous solution of phenol and tannin and stained with a freshly prepared solution of ammonia and silver nitrate. The X-bodies had the appearance of very small, round, dark brown grains, more or less visible against the yellow tobacco background.

N. D. Khrobrykh (pp. 27–30) discusses the results of experiments with various forms of *Spongospora subterranea* from different varieties of potatoes of different geographical origin and arrives at the conclusion that these forms are not biotypes or geographical races, but 'ecotypes', dependent on the host variety, the height and to some extent the size of their pustules varying with the humidity and aeration of the soil.

B. P. Matzulevitch (pp. 31–32) applied the biological and serological methods of diagnosing rugose and streak mosaic diseases of potato to corresponding halves of healthy and diseased tubers of 11 different varieties. The results showed that rugose mosaic was correctly diagnosed by the serological method in 9 out of 11 tubers tested, and streak mosaic in 25 out of 28 [cf. ibid., xviii, p. 127].

V. I. Vzoroff (pp. 40–45) gives a list of 60 bacteria distributed throughout U.S.S.R. with their respective hosts, including the following species recorded for the first time in Europe: *Bacterium aleuritidis* on tung, *Bact. atrofaciens* on tomato and potato, *Bact. cerasi* on fruit trees, *Bact.*

croci on onion, *Bact. hibisci* on *Hibiscus*, *Bact.* [*Aplanobacter*] *insidiosum* on lucerne, *Bact. jaggeri* [ibid., xvii, p. 660] on celery, *Bact. oryzae* n.sp. [without a diagnosis] on rice, *Bact. phaseoli* var. *sojense* on soy-bean [ibid., xviii, p. 368], *Bact. ricinicola* n.sp. [without a diagnosis] on the castor plant [*Ricinus communis*], *Bact. striaefaciens* on oats and barley, *Bact. vesicatorium* on tomato, *Bact. vignae* and its var. *leguminophilum* on cowpea [ibid., xvi, p. 85], *Bact. vitians* on lettuce [ibid., xvi, p. 302], and *Bact. cerealium* on barley. The material for this study, consisting of over 900 samples of 98 plants received from 82 different parts of the Soviet Union, was examined in pure culture and identified by the standard technique of the biological department of the Rostoff Experiment Station for Plant Protection.

N. P. Markevitch (pp. 45–50) found that when potato tubers infected with *S. subterranea* were grown in pots in either artificially infected or clean soil with a moisture content of 90 to 100 per cent. and a hydrogen-ion concentration of P_H 6·3 to 6·7, the percentage of infection was dependent upon the temperature, being 70 and 63·7 at mean daily temperatures of between 15·5° and 19·5° C., respectively, and only 4 and 2·9 at between 18·7° and 24·2°, respectively, while the hydrogen-ion concentration of the soil exerted no influence. Infection originated mainly through infested soil, but partly through infected seed material and utensils, and was actively spread by earthworms. The incubation period in artificially infected plants lasted from 19 to 25 days. In a comparative study of eight samples of infected material from five different districts, four distinct forms of the fungus were isolated, which varied in the size and height of the pustules and some other basic characters. These forms are regarded as ecological forms mainly dependent on the variety of potato.

V. F. Volkoff (pp. 67–69) conducted experiments for the control of *Loxostege sticticalis* with strains 1 to 5 of *Beauveria bassiana* [cf. ibid., xvii, p. 744] isolated from larvae of *L. sticticalis*, and strains 6 and 7 of the same fungus isolated from *Agrotis* [*Euxoa*] *segetum*. Artificial infection experiments by dusting or spraying with spores under laboratory conditions gave the following results: at a temperature of 20° to 23·6° C. and relative air humidity of 54 to 82 per cent. strains 1 to 7 killed 5, 6, 6, 8, 5, 3, and 2 larvae out of 10, respectively; under conditions closely approximating to those in nature strains 1 to 5 all gave good results, particularly strain 4, which killed all the larvae. Mortality among butterflies of *L. sticticalis* put into glasses contaminated with pure cultures of *B. bassiana* was 90 per cent. of the females and 60 per cent. of the males after 4 to 7 days, as compared with 20 and 50 per cent., respectively, in the control, and no eggs were laid. Dusting was generally observed to give better results than spraying. Field experiments with strains 6 and 7 were unsuccessful, but better results may be expected with strain 4.

Mme A. Y. Zaitseva (pp. 69–73) used spores of three strains of Métalnikov's bacilli [ibid., xvii, p. 232] in experiments on the control of larvae of various noxious insects. In the laboratory, applications of the bacillus in the form of dusts killed 40 per cent. of the larvae of *Loxostege sticticalis* and all those of *Pyrausta nubilalis*, *Pieris brassicae*, and *P. rapae*, and applications by sprinkling killed up to 88, 95, 100, and

100 per cent. of the larvae of *L. sticticalis*, *P. brassicae*, *P. rapae*, and *Plutella maculipennis*, respectively. In the field up to 92, 77, 45, and 88 per cent. of the larvae of *P. maculipennis*, *Pieris rapae*, *Barathra brassicae*, and *P. brassicae*, respectively, were killed by dusting, and up to 100 and 73 per cent. of the larvae of *P. brassicae* and *P. rapae*, respectively, by sprinkling. The mortality of the larvae was more than three times as high at a temperature of 24° C. than at 14°. The bacilli were also found to exercise an antagonistic effect on *Ustilago zeae* on maize under field conditions, though the results were less marked than those obtained in 1934 by V. P. Pospeloff [ibid., xvi, p. 36], owing to the high temperatures and low humidity predominant in 1936.

M. V. Pilat (pp. 73–75) describes histological studies on the penetration of the chitin of *L. sticticalis* larvae by *B. bassiana*. The hyphae of the fungus were observed to enter the body of the larva either from the outside, penetrating the chitin and branching downwards till they reach and destroy the hypoderm, or through the intestinal tract, in which case the hyphae are thicker, branch more frequently, and often change their direction, but ultimately reach the chitin, form spherical swellings just beneath it, penetrate it, and then sporulate on the outside. Analogous observations were made on *P. brassicae*, *A.* [*E.*] *segetum*, and *Melolontha hippocastani*. *Spicaria fumosa-rosea* [ibid., xvi, p. 532] and *Metarrhizium anisopliae* [ibid., xvii, p. 456] gave similar results. The author is inclined to ascribe the method of penetration of the chitin by the hyphae to the solvent action of the fungus, as lighter patches have often been observed to form round the growing hyphae.

Mme A. A. Evlakhova (pp. 75–77) in inoculation experiments with spore suspensions of *Cephalosporium lecanii* [cf. ibid., xvii, p. 526] found that strain No. 14 of the fungus isolated from *Coccus hesperidum* caused 100 per cent. mortality of *Ceroplastes sinensis* on tangerine trees in the field (or 46 to 69 per cent. when rain set in two or three days after sprinkling), and strain No. 6, isolated from *Saissetia oleae*, caused up to 32·5 per cent. mortality, while the insects on the unsprinkled branches of the trees remained unaffected. The fungus was observed to penetrate the thick chitin and wax layer of the insects from within.

I. P. Yatzenko and B. F. Snigur (pp. 96–99) give some details on the improved construction of a mobile power sprayer S-2, designed for use in beet plantations.

N. K. Tarnovitch (pp. 99–104) describes and gives diagrams of a new sprayer for work on cotton, lucerne, or garden crops, which is mounted on a tractor and can be served by the tractor-driver without additional workers. The spraying hose being fixed in front of the tractor the driver is able to watch and direct it. The machine is calculated to spray 22 hect. in a 10-hour working day.

Gosset (A.), Tchakirian (A.), & Magrou (J.). **Sur la composition chimique des tumeurs bactériennes de Pelargonium zonale et des tissus aux dépens desquels elles se développent.** [On the chemical composition of the bacterial tumours of *Pelargonium zonale* and of the tissues at the expense of which they develop.]—*C. R. Acad. Sci., Paris*, ccviii, 7, pp. 474–477, 1939.

Details are given of the technique and results of chemical analyses

of crown gall (*Bacterium tumefaciens*) tumours on *Pelargonium zonale* [*R.A.M.*, xviii, p. 296] and of the host tissues involved in their development. The inoculations were carried out with the hop strain of the bacterium on 28th February, 1935, and three collections of test material made on the following 23rd May, 3rd July, and 15th August.

There was found to be very little difference in the ash and water contents of the tumours, stems, and leaves. The tumours contained considerably more potash and phosphorus than the plant organs, the figures for these two elements being as follows: (1) potash (May), tumours, stems, and leaves, 35·1, 22, and 23·3 per cent., respectively, of fresh substance, the corresponding amounts for July and August being 37·7, 17·7, and 26·2 and 36·6, 19·7, and 16·9, respectively; (2) phosphorus (May), tumours, stems, and leaves, 2·9, 1·4, and 2·5; July, 2·6, 0·6, and 1·2; and August, 3·6, 1·4, and 1·8 per cent., respectively. On the other hand, the silicon, calcium, and magnesium contents of the tumours were lower than those of the host stems and leaves. Thus, the silicon contents of the tumours in May, July, and August were 0·94, 0·91, 0·89 per cent., respectively, the corresponding figures for the stems and foliage being 2·87, 1·66, and 1·25, and 14·12, 12·8, and 9·38, respectively. For magnesium the following values were obtained in the three analyses: tumours, 1·9, 1·8, and 1·8, stems, 2·4, 2·2, and 2·1, and leaves, 3·5, 2·5, and 2·6, the corresponding figures for calcium being 10·2, 10·4, and 11, 23·3, 25·9, and 22, and 16·3, 18·6, and 23. The iron, aluminium, and sodium data were too variable to admit of any definite conclusion as to their bearing on the matter under investigation.

Hornbostel (W.). **Versuche über Wurzelkropfbekämpfung.** [Experiments on the control of crown gall.]—*Z. PflKrankh.*, xlix, 1, pp. 1–11, 5 figs., 1938.

In pot experiments with one-year-old apple and pear stocks, in which the trees were wounded at the root collar and the wounds smeared prior to planting with a pure culture of *Pseudomonas* [*Bacterium*] *tumefaciens* [see preceding abstract] either immediately or some time later, tumour development occurred only in stocks inoculated immediately after injury. In a second similar experiment inspection at the end of the vegetation period of 45 apple and 40 pear stocks showed 63, 12, 0, 0, and 0 per cent. infection in apple stocks inoculated and planted immediately, 2, 7, 10, and 20 days after wounding, respectively, and 83, 60, 38, 8, and 0 per cent. in pear stocks similarly treated, respectively.

In field experiments the roots of one-year-old apple stocks were pruned after dipping for ten minutes in a 0·5 per cent. uspulun solution in order to avoid accidental infection, stored for different periods in the field or cool store, and then inoculated either with pure cultures of the parasite or with tumour material, and planted. The results showed that the introduction of an interval between root pruning and planting reduces the amount of infection. In the series inoculated with tumour material, the controls inoculated and planted immediately after pruning showed 11·7 per cent. healthy and 77·8 per cent. diseased trees (the rest being doubtful), while stocks inoculated and planted from 2 to 19 days after pruning yielded an average of 68·4 per cent. healthy and

25·1 per cent. diseased trees; the average number of tumours per tree in the latter stocks was 0·52 as compared with 3·8 in the controls. In the series inoculated with pure cultures the controls showed 50·5 per cent. healthy and 41·9 per cent. diseased trees, with an average of 0·67 tumours per tree, while stocks inoculated and planted from 4 to 19 days after pruning showed 91 per cent. healthy and 6·2 per cent. diseased trees, with an average of 0·12 tumours per tree. The temperature during storage did not seem to have a significant influence on infection.

It is concluded that the formation of callus growth over the wounds inflicted in pruning occurs within a few days after pruning, and that delaying planting for this period will reduce the infection to an appreciable degree. It is also recommended that the soil at planting be disinfected with 1 per cent. uspulun or ceresan or 0·5 per cent. abavit and the pruned stocks dipped in 1 per cent. uspulun or ceresan loam emulsion prior to planting.

HORNBOSTEL (W.). **Die Beziehungen zwischen Bodenreaktion und Wirkung quecksilberhaltiger Bodenentseuchungsmittel auf den Wurzelkropferreger Pseudomonas tumefaciens Smith et Townsend.** [The relations between soil reaction and the effect of mercury-containing soil disinfectants on the agent of crown gall, *Pseudomonas tumefaciens* Smith & Townsend.]—*Z. PflKrankh.*, xlix, 2, pp. 77–93, 1939.

The *doses curativae* of two standard soil disinfectants for the control of crown gall (*Pseudomonas* [*Bacterium*] *tumefaciens*) viz., uspulun for soil disinfection and ceresan liquid (U. 564) [see preceding abstracts], were determined in laboratory experiments and found to depend on the hydrogen-ion concentration of the soil (sandy loess). The efficiency of the two preparations was materially increased in acid soil (P_H 6·1), twentyfold in the case of uspulun, and fivefold in that of ceresan. Thus, in alkaline soil (P_H 7·6) a 0·01 per cent. solution of uspulun is required to destroy the bacteria in 24 hours, whereas comparable effects are achieved in the same period at P_H 6·1 by a 0·0005 per cent. concentration. In the acid soil ceresan exerted a bactericidal influence at 0·01 per cent., whereas in the alkaline a 0·05 per cent. solution was necessary to produce the same results. These data were confirmed by tests of the pathogenicity of the two preparations to *Bact. tumefaciens* on a liquid bouillon medium, which increased parallel with a fall in the hydrogen-ion concentration. Phenol and quinosol [ibid., xv, pp. 61, 420] proved to be inferior to uspulun and ceresan for the purpose of these experiments.

BLATTNÝ (C.), DUCHOŇ (F.), & STRAŇÁK (J.). **Přispěvek k seznání vztahu mezi obsahem hlavních rostlinných živin ve slámě Pšenic a jejich napadením rzi travní Pšeničnou (Puccinia graminis Pers. f. tritici Er.).** [Contribution to the study of the relationship of the content of the chief plant nutrients in Wheat straw to susceptibility to black rust (*Puccinia graminis* Pers. f. *tritici* Erikss.).]—*Ann. Acad. tchécosl. Agric.*, xiii, 4, pp. 529–534, 1938. [German summary.]

The authors state that the results of the chemical analysis of the

straw of wheat varieties exhibiting different degrees of susceptibility or resistance to black rust (*Puccinia graminis tritici*) did not indicate any direct relationship between susceptibility or resistance and the content of any individual essential element. There was evidence, however, that any upsetting of the balance in the wheat plant between the groups of protein- (nitrogen and phosphorus) and skeleton-building elements (potassium, calcium, and manganese) increased susceptibility to rust or, more generally, reduced the grain yield of the plant. From a purely practical standpoint, these results are considered to indicate the inadvisability of applying mineral fertilizers to wheat fields without preliminary analysis of the soil.

KUMMER (H.). **Untersuchungen über die biologische Spezialisierung des Schwarzrostes in Württemberg.** [Studies on the biologic specialization of black rust in Württemberg.]—*Z. PflKrankh.*, xlix, 2, pp. 65–76, 1939.

Ten collections of black rust (*Puccinia graminis*) from various parts of Württemberg [*R.A.M.*, xvii, p. 21] in 1937 yielded five biotypes of the fungus, of which race 14 [ibid., xvii, p. 225] predominated, occurring in six samples, mostly on emmer, which also contracted severe infection in inoculation experiments. Race 40 [loc. cit.] was detected twice on wheat, and 143, originally reported by Dodoff from Bulgaria [as 129: ibid., xiii, p. 500], once on barley. Race 56 was isolated from a collection of the rust on wheat referred to E. C. Stakman for determination, this being the first record of its occurrence in Europe. A new race (not yet numbered) from emmer was tested by Stakman and found to be severely pathogenic to the Hope variety but only slightly so to Thatcher; in the writer's experiments it produced heavy infection on emmer.

The only sample of oats among the collections yielded race 6 of *P. g. avenae* [ibid., xvii, p. 225], which caused severe damage to the Hohenheim No. 5 and Jäger's Alb in inoculation trials and is probably responsible for the not infrequent local epidemics of black rust on this host.

The two races of *P. g. secalis* isolated from *Agropyron repens* were actively pathogenic to cultivated rye, emphasizing the importance of wild grasses in the spread of the rust.

ASUYAMA (H.). **On the period of infection of Wheat seedlings by leaf rust, Puccinia rubigo-vera tritici.**—*Ann. phytopath. Soc. Japan*, viii, 4, pp. 298–308, 1939. [Japanese, with English summary.]

Observations on wheat seedlings inoculated with the uredospores of *Puccinia rubigo-vera tritici* (*P. triticina*) [*R.A.M.*, xii, p. 499] and kept in a moist chamber at various constant temperatures showed that infection occurred with the formation of a penetration tube from the appressorium, and inoculated seedlings require to be maintained in favourable conditions until this stage is attained in order to obtain infection. At about 23° C. the uredospores germinated within one hour, and appressoria were found three hours after inoculation. Approximately one-third to one-half of the germinated spores produced appressoria after seven to nine hours. Penetration tubes were noted four hours,

and most frequently nine hours, after inoculation; at 24 hours from inoculation, 93·1 per cent. of the appressoria showed substomatal vesicles and 77·6 per cent. had developed infection hyphae.

Spore germination was inhibited at 28°; at 15° to 25° appressoria formed three or more hours after inoculation, and at 8° to 13° they formed six or more hours after inoculation. At temperatures over 15° stomatal entry occurred three to six hours after inoculation, while at those below 13° it took place nine hours after inoculation. At temperatures over 18° haustoria formed 14 to 24 hours after inoculation, while at 8° infecting hyphae were still developing 24 hours after inoculation.

The germination and subsequent development of uredospores kept in a refrigerator for 158 days were markedly retarded in comparison with fresh spores.

The shortest periods for infection at 8° to 13°, 15° to 20°, and 23° were, respectively, 9, 6, and 3 hours. Abundant infection resulted when the inoculated surface was kept moist for 14 hours at 8° to 13° and for six hours at temperatures over 15°. In general, the optimum temperature for the infection of wheat by *P. triticina* would appear to be from 18° to 25°.

Adams (W. E.). **Inheritance of resistance to leaf rust in common Wheat.**—*J. Amer. Soc. Agron.*, xxxi, 1, pp. 35–40, 4 graphs, 1939.

A tabulated account is given of the writer's investigations in North Carolina in 1934–5 on the inheritance of resistance to leaf rust (*Puccinia triticina*) [*R.A.M.*, xiii, p. 428; xiv, p. 497; xvi, p. 90, et passim] in crosses between the resistant, hard red spring wheat Hope and three leading susceptible, soft red, winter varieties, Leap's Prolific, Fulcaster, and Purplestraw.

The F_1 generation developed very little infection, due either to paucity of inoculum, unfavourable weather conditions for spore production, or both. In the F_2 the Hope×Leap's Prolific cross segregated into immune, intermediate, and susceptible plants, of which 81 per cent. showed below 25 per cent. infection and nine individuals less than 1 per cent. The reciprocal cross yielded slightly less resistant progeny, with 63 per cent. showing below 50 per cent. infection, 31 per cent. in the 25 to 50 per cent. class, and two plants 1 to 4 per cent. None of the Purplestraw×Hope plants showed over 50 per cent. infection, 91 per cent. showed less than 25 per cent., and 27 per cent. under 5 per cent. The highest degree of resistance was displayed by the Hope×Fulcaster cross, with 70 per cent. below 4 per cent. and all less than 50 per cent. rusted. In the F_3 Purplestraw×Hope showed four rows under 1 per cent., six intermediate, and three fairly heavily infected. Three rows of Hope×Fulcaster showed less than 1 per cent. infection, five were intermediate, and three were severely attacked. The offspring of Hope×Leap's Prolific produced six resistant rows (most of the plants healthy), five intermediate, and six with over 50 per cent. infection, while in the reciprocal cross there were five rows showing under 1 per cent. infection, five intermediate, and three in which all the plants were over 50 per cent. rusted.

An evaluation of these data is complicated by the variable soil and climatic conditions under which the tests were conducted in two

localities, the differing times of maturity of the wheats, and the impossibility of avoiding a mixture of physiologic races of the rust. It would nevertheless appear from the segregation of the hybrid descendants into well-marked infection categories that resistance to *P. triticina* is a heritable character.

Rosenstiel (K. v.). **Untersuchungen über den Weizenmeltau Erysiphe graminis tritici (D.C.), seine physiologische Spezialisierung sowie die züchterischen Möglichkeiten seiner Bekämpfung (vorläufige Mitteilung).** [Investigations on the Wheat mildew *Erysiphe graminis tritici* (DC.), its physiological specialization, and the possibilities of controlling it by breeding (preliminary report).—*Züchter*, x, 9–11, pp. 247–255, 4 figs., 1938.

The author tested the wheat material collected by the German Hindu Kush expedition of 1935 and the wheat assortment from Müncheberg, Mark Brandenburg, for resistance to *Erysiphe graminis* [*R.A.M.*, xiii, p. 431], and having thus established a number of resistant varieties studied the physiological specialization of the fungus. Isolations of single spore lines were not made and a test assortment of differential varieties has not yet been decided upon owing to the great number of new races continually being discovered during the study. Six populations of the fungus, however, namely, one from Müncheberg, two from Alt-Reichenau, Silesia, three isolated from population 1 on T 2948 Normandie, four found on T 3397 Christiansen 16 (*Triticum durum*), five from Huckelheim (near Frankfurt-am-Main), and six isolated from population 5 on T 1643, T 2922, T 3276, and T 4199, were differentiated and are considered probably to be distinct physiological races, though as single spore lines have not been studied the author prefers to term them populations. Wheat varieties Red summer spelt, Christiansen 118, Persian heavy summer wheat, 13392, and Christiansen 919 were found to be resistant to all six populations. The other 72 strains tested are classified in five groups according to their capacity to resist 5, 4, 3, 2, or 1 populations.

Gram (E.). **Forsøg med Korndyrkning og Fodsyge.** [Experiments with cereal cultivation and foot rot.]—*Tidsskr. Planteavl*, xliii, 4, pp. 561–605, 8 graphs, 1938. [English summary.]

A detailed, tabulated account is given of a series of experiments, mostly planned by C. A. Jørgensen and carried out from 1923 to 1937 in Denmark, to determine the effect of summer crops of oats and barley on the development of foot rot (*Ophiobolus graminis*) [*R.A.M.*, ix, p. 741] and *Cercosporella herpotrichoides* [ibid., xiii, p. 623] on winter rye and wheat.

Seed-grain disinfection failed to produce any significant cumulative reduction in the incidence of infection in four years' consecutive trials. The observations made by Kølpin Ravn and Rostrup in the eighteen-nineties regarding the stronger predisposition to foot rot of wheat following barley than in the same crop succeeding oats were largely confirmed in these experiments. Foot rot is prevalent in barley but the actual damage from this cause is generally unimportant, its influence being more of an indirect character; severe attacks on oats are

rare. In plots well supplied with nitrogen [cf. ibid., xviii, p. 241] the average grain yield of rye was 25 per cent. less following two years of cereals than after three to five of root crops; there was a similar reduction in wheat succeeding three to four years of cereals, five or six of which caused a 50 per cent. loss in the wheat crop. Potatoes and beets were found to be the best crops to precede rye, oats and barley, particularly the latter, being unfavourable; the yield following barley was 12 to 20 per cent. lower than that from stands succeeding oats. No appreciable difference in the condition of the wheat crop was observed following one barley or oats crop, but the cumulative influence of the former was definitely adverse.

In a test on very fertile soil at Lyngby wheat was grown in two rotations, viz., A, consisting of wheat-barley-wheat-barley-wheat, and B, hay-oats-potatoes-peas and mustard-wheat, the incidence of foot rot was as follows: A with and without 300 kg. nitrate per hect., 52 and 78 per cent., respectively; B with and without nitrate, 6 and 10 per cent., respectively, the corresponding grain yields in the four plots being 1,320, 610, 3,090, and 2,090 kg. per hect., respectively. Nitrate is ineffectual against heavy foot rot infection, but may serve to reduce the losses caused by the disease as long as super-luxuriant growth and lodging are not induced.

It is concluded from these observations that the crop most liable to predispose wheat and rye to foot rot is barley, followed in descending order of injuriousness by oats, red clover [*Trifolium pratense*] grass-mixture, fodder beets, lucerne-grass mixture, and fallow.

HANSEN (H. R.). **Om Fodsyge hos Korn paa Grundlag af udenlandske Undersøgelser.** [On foot rot of cereals on the basis of foreign investigations.]—*Tidsskr. Planteavl*, xliii, 4, pp. 630–645, 4 pl., 1938.

This is a summary of recent outstanding developments in research on cereal foot rots (chiefly *Ophiobolus graminis* and *Cercosporella herpotrichoides*) [see preceding abstract] in various countries. Attention is drawn to the restricted distribution of *C. herpotrichoides* in comparison with the very widespread *O. graminis*.

GARRETT (S. D.). **Soil conditions and the take-all disease of Wheat. IV. Factors limiting infection by ascospores of Ophiobolus graminis.** —*Ann. appl. Biol.*, xxvi, 1, pp. 47–55, 1 pl., 1939.

In further experiments on the take-all disease of wheat (*Ophiobolus graminis*) [*R.A.M.*, xviii, p. 171], the author failed to produce infection of seedlings by the ascospores in a variety of natural soils and in sand, although the ascospores usually showed a germination of over 90 per cent. on 0·5 per cent. dextrose agar, and the resulting cultures produced infection as easily as those from the mycelium. On sterilized soil in tubes, on the other hand, infection with ascospores was successful in 17 out of 20 seedlings and in all seedlings on sterile sand with or without the addition of 1 per cent. glucose solution. The ascospore infection is, therefore, considered to be inhibited in unsterilized soils and sand by the antagonism or more probably the competition of other soil micro-organisms, which assimilate the nutritive substances excreted from the

growing and developing roots. Only under sterile conditions is this organic detritus available to the ascospores. These experimental results render it unlikely that the ascospores can play any part in the propagation and dispersal of the disease in the field.

NISIKADO (Y.) & HIGUTI (T.). **Comparative studies on Cephalosporium gramineum Nisikado et Ikata, which causes the stripe disease of Wheat, and C. acremonium Corda.**—*Ber. Ōhara Inst.*, viii, 3, pp. 283–304, 5 pls., 4 graphs, 1938.

The results of comparative studies on *Cephalosporium gramineum*, the agent of stripe disease of wheat in Japan [*R.A.M.*, xvii, p. 593], isolated from blackened culms of the Tinko-Komugi variety and *Alopecurus agrestis*, and three strains of *C. acremonium*, associated with black bundle of maize [ibid., xvi, p. 168], from Holland, Germany, and Italy, revealed the following important differences. The conidia of *C. gramineum* on potato dextrose agar at 20° C. measured 4 to 12 by 1 to 3·3 (average 7·22 by 2·09) μ. The orange-yellow colour of the colonies of *C. acremonium* in diffused daylight was absent from those of *C. gramineum*. The minimum, optimum, and maximum temperatures for the growth of *C. gramineum* were 5°, 20°, and 30°, respectively, compared with 10°, 30°, and 38° for *C. acremonium*. In inoculation experiments *C. acremonium* proved to be unable to attack wheat plants and cause the typical systemic symptoms of stripe disease. The two species are, therefore, quite distinct.

D'OLIVEIRA (B.). **Studies on Puccinia anomala Rost. I. Physiologic races on cultivated Barleys.**—*Ann. appl. Biol.*, xxvi, 1, pp. 56–82, 1939.

In a study based on 77 collections of *Puccinia anomala* from cultivated barleys obtained from England, Portugal [*R.A.M.*, xvii, p. 593], and Spain, carried out from 1933 to 1936 partly at Cambridge and partly at Lisbon, 11 new physiologic races of *P. anomala* were isolated from 82 cultures of the fungus and were numbered 12 to 22. The differentiation of physiologic races was made chiefly on Hey's selection of differential barleys, in addition to which seven of Mains's differential varieties and the Egyptian 4-rowed summer barley, selected by Gassner and Straib, were used. Monospore cultures of *P. anomala* were obtained by three methods, among them a new one, consisting in the transfer of individual spores from a dry glass slide with a wet glass capillary needle to the leaf of a seedling. All stock cultures were maintained on seedlings of Spratt Archer barley kept under spore-proof cellophane cylinders or in a rust-free room of the greenhouse.

Of the new races, 12 was found to be widely distributed in Great Britain, Portugal, and Spain, the other ten were localized; races 13, 14, 15, and probably 18 were found in Britain; races 18, 19, 20, and 21 in Portugal; and races 16, 17, 21, and 22 in Spain. A mutant of *P. anomala*, differing in colour (orange and yellow pustules instead of the normal brown ones) and pathogenicity, arose from an unstable culture of race 14 cultivated on *Hordeum vulgare pallidum* (Sudan), and was numbered race 23.

New physiologic races were obtained from aecidia produced on *Ornithogalum umbellatum* by hybridization. The races 12, 13, and 23

proved to be heterozygous. From self-fertilized material of race 12, the new races 24, 25, 26, and 27 were isolated in addition to races 12, 16 (?), and 19; by selfing race 13, races 12 (?), 13, 22, 24, and the new races 28 and 29 were obtained; and the selfing of race 23 yielded races 12, 19, 20, and 22. The progenies of a reciprocal cross between races 13 and 23 gave rise to one new race, 30, in one direction, and to the same race and 18, in the other. This result is explained on the basis of cytoplasmic inheritance. Several biotypes of races 12 and 13 were found, which seem to link up the two races.

The author suggests the following set of varieties for the purpose of more efficient differentiation: Breustedt's Schladen, *H. v. speciale*, Friedrichswerth Berg winter barley, Australian Recka, Lichtis Lechtaler, Samaria 4-rowed, *H. v. pallidum* (Sudan), Egyptian 4-rowed summer, Quinn C.I. 1024, and Bolivia C.I. 1257, to which Oderbruck C.I. 940 may be added as a subsidiary variety. A table of the reaction types of the thirty physiologic races now known of *P. anomala* on this proposed set of barleys is given and an analytical key for their determination provided. It is concluded from field observations that *P. anomala* may overwinter at Cambridge either in its uredospore stage or as dormant mycelium, and that in Portugal the uredospores survive the summer in the mountains.

SHANDS (R. G.). **Chevron, a Barley variety resistant to stem rust and other diseases.**—*Phytopathology*, xxix, 2, pp. 209–211, 1939.

Five years' observations at Madison, Wisconsin, on Chevron C.I. 1111, a four-rowed spring barley (*Hordeum vulgare pallidum*) of Swiss origin, have shown it to possess a degree of resistance to stem rust (*Puccinia graminis*) comparable to that of Peatland [*R.A.M.*, xii, p. 753]. In 1935 susceptible varieties contracted 20 to 25 per cent. infection, whereas the two resistant ones remained rust-free, and in 1937, when a severe natural outbreak of *P. graminis* developed in the barley nursery, Chevron showed an average of only 1 per cent. compared with 74·8 for 75 other varieties. Similar results were obtained in Iowa and Minnesota. All the 25 progenies of Chevron, selected at random, were likewise uniformly resistant to stem rust, the character being apparently inherited as a single dominant factor, judging by the segregation data of back-crosses with Wisconsin Pedigree 38, Velvet, X 152, and X 169. Chevron has further given proof of high resistance to scab (*Gibberella saubinetii*) and mildew (*Erysiphe graminis hordei*) [ibid., xvi, p. 376], and moderate resistance to stripe (*Helminthosporium gramineum*), but it is susceptible to leaf rust (*P. anomala*) [see preceding abstract], and apparently also to the sporidium-forming smuts [*Ustilago hordei* and *U. medians*: ibid., xvi, p. 737].

KUTZEVOL (E. A.). К вопросу об искусственном заражении Ячменя каменной головней **(Ustilago hordei Kellerm. et Sw.)** для целей селекции. [Artificial infection of Barley with covered smut (*Ustilago hordei* Kellerm. & Sw.) for Barley-breeding purposes.]—*Pl. Prot., Leningr., 1938*, 17, pp. 86–88, 1938. [English summary.]

Experiments in 1936 at the Donetz Experimental Station showed that dusting barley seeds, the seed coats of which had been slightly

lifted over the embryo, with covered smut (*Ustilago hordei*) spores resulted in 32·98 to 45·57 (average 39·5) per cent. infection in the ensuing crops, as compared with an average of 2·85 per cent. in the controls with untouched seed coats. Sprinkling the incised seeds with a river water suspension, in which the spores had been allowed to germinate for 24 hours at 20° C., raised the percentage infection to between 47·11 and 58·08 (average 52·48), but infection rapidly fell off when the spores were left to germinate for longer periods (48 or 72 hours) in the suspension. It is considered that mechanical injury sustained by barley seeds during threshing undoubtedly increases its susceptibility to infection with covered smut.

MARLAND (A. T.). Скорость инфекции Овса уредоспорами **(Puccinia coronifera Kleb.).** [Time required for infection of Oat plants by uredospores (*Puccinia coronifera* Kleb.).]—*Pl. Prot., Leningr., 1938*, 17, pp. 134–137, 1938.

Brief details are given of experiments the results of which showed that on the Golden Rain oat variety the germ-tubes of uredospores of *Puccinia coronifera* [*P. lolii*] had penetrated the surface of the leaves after three hours' incubation at the optimum temperature (20° to 22·8° C.) for the germination of the spores; the shortest time for the appearance of the rust pustules was five hours at temperatures ranging from 17° to 27°. No infection was observed below 4° or above 31·4°, and the first pustules appeared after 24 hours at 4·5° to 5·5°, and after 12 at 30° to 31·4°.

REID (W. D.). **Halo-blight of Oats.**—*N.Z. J. Sci. Tech.*, A, xx, 4, pp. 266–268, 2 figs., 1938.

Attention is drawn to the detection, in December, 1937, of halo blight of oats (*Bacterium coronafaciens*) [*R.A.M.*, xviii, p. 235] in the Lincoln and Wanganui districts of New Zealand, this being the first record of the disease for the country.

DUNLAP (A. A.). **Lodging of Sorghum in Texas.**—*Plant Dis. Reptr*, xxii, 20, pp. 402–403, 1938. [Mimeographed.]

Severe lodging of sorghum, especially the pithy-stemmed varieties, such as Milo and Feterita, in north-western Texas in the late summer and early autumn of 1938 was found to be associated with high percentages of infection by *Sclerotium bataticola* [*Macrophomina phaseoli*: cf. *R.A.M.*, xi, p. 711; xvi, p. 310]. Affected spots in the field are circular, with nearly all the stalks broken a few inches above soil-level. Other symptoms include drying out of the entire plant, premature ripening, under-developed kernels, and disintegration of the pith in the lower stalk, leading to collapse of the stem. The disease may have been favoured by the unusual weather conditions of the year, the abundant rainfall during the early part of the growing season being followed by a dry spell from mid-July to early October. In a few cases the sclerotia of the fungus were detected in the short stubs of decayed roots of standing plants near the edge of a lodged area. *M. phaseoli*, sometimes accompanied by an unidentified fungus, was consistently isolated from the diseased tissues.

Gemmell (A. R.). **Synergism in fruit-rotting fungi.**—*Chron. bot.*, v, 1, pp. 41–42, 1939.

Cultural studies by the author demonstrated that a mixed culture of *Penicillium digitatum* and *Oospora citri-aurantii* [*R.A.M.*, ix, p. 106] grew more rapidly than a pure culture of either. On a medium deficient in nitrogen, the latter fungus failed to grow alone, but when it was inoculated along with *P. digitatum* a colony developed comprising *O. citri-aurantii* as the dominant species, with a diameter at least four times that of the pure culture of *O. citri-aurantii*. Evidence was obtained that the filtrate of a liquid medium in which *P. digitatum* had been grown had the same ability, even after autoclaving, of stimulating the growth of *O. citri-aurantii*. The effect of the thermostable substance is most marked on a nitrogen-deficient medium, and the substance is therefore thought to be of the nature of a bios. *O. citri-aurantii* appears to be heterotrophic with regard to proteins, and to depend on some other organism for its supply of complex nitrogen compounds. *P. digitatum*, on the other hand, appears to be autotrophic in regard to protein supply, and the stimulatory substance to be a by-product in its nitrogen metabolism.

The fact that more rotting is caused in citrus fruits when these two fungi are present together than when only one is present is attributed to stimulation of *O. citri-aurantii* by some by-product of *P. digitatum*, and to the removal of some staling substance hindering the growth of the latter. This apparent case of synergism is also one of metabiosis, in which, however, the mutual effects of the two fungi are virtually simultaneous.

Kreibohm de la Vega (G. A.). **Improductividad del Algodonero. Un interesante caso de acromania o puntas locas ('crazy-top'), observado en dos lotes de Algodón en el Departamento de Trancas, provincia de Tucumán.** [Unproductiveness of Cotton. An interesting case of acromania or 'crazy top' observed in two Cotton stands in the Department of Trancas, Province of Tucumán.]—*Rev. industr. agríc. Tucumán*, xxviii, 4–6, pp. 127–133, 5 figs., 1938.

Attention is drawn to the occurrence of crazy top or acromania affecting 80 per cent. of the plants in two cotton [*R.A.M.*, xiv, p. 629] stands in Tucumán, Argentine Republic.

Andrews (F. W.) & Clouston (T. W.). **Section of Botany and Plant Pathology.**—*Rep. Dep. Agric. For., Sudan Govt, 1937*, Part II, pp. 32–46, 7 graphs, [? 1939].

In this report on plant disease work in the Anglo-Egyptian Sudan in 1936–7 [cf. *R.A.M.*, xvii, p. 521] the authors state that cotton blackarm [*Bacterium malvacearum*: ibid., xviii, p. 23] was generally distributed through the Gezira in the period in question, though severe infection occurred for the most part only in patches. The later sown fields had less disease than those sown earlier, and in many of the former infection was negligible or absent. In many instances the distribution of outbreaks showed no relation to the adjacent old cotton land; apparently the careful cleaning of the latter at the end of the picking season had removed large amounts of very infective material.

That in some fields infection was concentrated on the side nearest the old cotton land indicated that the cleaning up was executed with insufficient thoroughness in places. A search of the 1935–6 plots on the Gezira research farm resulted in the first infected volunteer seedling being found on 28th August, 1936, a record lateness of appearance since 1932. Late rains favoured spread, and the evidence indicated that the clean-up of infected debris had not been entirely successful.

All persons passing into the Wad Hilal area were searched for seed cotton and cotton sticks, but in spite of this precaution, a certain amount of cotton was brought in and later proved of much importance. Both in Wad Hilal and Fawar infection spread normally. It is clear that attempts to prevent the appearance of the disease in new areas are hopeless unless the introduction of cotton remains into such areas can be effectively stopped.

When sterilized cotton seed was sown in plots on which infected debris had been sprayed with 20 per cent. sulphuric acid, marked decrease in infection resulted as compared with the unsprayed controls. A liquid disinfectant (in the experimental stage as yet) mixed with the cotton seed and allowed to dry on it was more lethal to *Bact. malvacearum* than abavit B.

Leaf curl [ibid., xvii, p. 522] was present only to a very slight extent in the southern half of the Gezira, which had been planted with resistant X 1530 or X 1530A cotton.

The first outbreak of wilt [loc. cit.] definitely associated with the rotting of secondarily thickened roots occurred on 1st December, 1936. By the end of January, 1937, nearly 70 per cent. of the plants (X 1530) had wilted in the area studied on the Gezira research farm, recovery subsequently reaching nearly 100 per cent. Progress is reported in selecting resistant plants from a plot of X 1530 showing a high percentage of wilt.

Counts of wilting plants made early in January, 1937, on numerous plots undergoing a wide range of treatments indicated that local soil variations were more important in determining wilt incidence than experimental treatments, while during the season concerned X 1530 was more susceptible than Sakel. Fallowing reduced wilt incidence as compared with cropping with lubia [*Dolichos lablab*] or durra [*Sorghum vulgare*]. Increasing the number of plants per hole appeared to reduce wilt incidence, as did nitrogen applications.

Fungi isolated from discoloured fine roots of X 1530 and Sakel cotton included an unidentified fungus, referred to as 'XT' [loc. cit.], *Cylindrocarpon didymum*, *Macrophomina phaseoli*, a *Rhizoctonia* species near *R.* [*Corticium*] *solani* [ibid., xviii, p. 248], *Pythium afertile*, *P. proliferum*, and *P. gracile*. Isolations from rotting secondarily thickened roots included the 'XT' fungus, *Cylindrocarpon didymum*, L-47 type (*Rhizoctonia* group), *R.* sp. (near *Corticium solani*), *M. phaseoli*, and *P.* sp. The roots of both varieties from the later sowing appeared to contain more hyphae than those of the earlier, this observation being confirmed by the numbers of isolations obtained from the two sowings. Rotting of the thickened roots occurred erratically with the L-47 type fungus and *R.* sp. in several treatments, mainly in very moist soil given a heavy application of sterilized, rotted organic matter. Both fungi seem able

under pot conditions to produce a root rot sufficient to cause wilting and death of seedlings.

Investigation into the effect of soil conditions on root development showed that the root system of plants heavily watered was smaller and penetrated less deeply into the soil than that of plants lightly or moderately watered. The roots of the heavily watered plants showed considerably more fungal infection than the others. The fine-root systems of 'debudded' plants were almost twice the size of plants not 'debudded', the evidence indicating that the maturing of buds and bolls by the plants reduces the total mass of fine roots but does not affect depth of penetration. It is considered that the improved growth of cotton noted on land previously cropped with salt bush [*Atriplex*] may probably be associated with the deeper soil cracking found in salt bush plots (reaching 5 ft. 9 in., as against 3 ft. 2½ in. in cotton plots).

A large proportion of *D. lablab* sown during the rains was attacked by *Bact. phaseoli*, but infection did not cause serious injury, and plants sown after the rains remained unaffected.

Good results were obtained by seed treatment against sorghum smut (*Sphacelotheca sorghi*) [ibid., xvii, p. 670; xviii, p. 18] with copper carbonate.

Other records include *M. phaseoli* causing a wilt of *Mucuna* sp., a wilt of broad beans [*Vicia faba*] from which *Fusarium moniliforme* [*Gibberella fujikuroi*] was the dominant isolation obtained, and a staining of cotton lint, with consequent loss of tensile length, due to *F. scirpi* var. *compactum*.

Brown (J. G.). **Cotton rust in Arizona.**—*Plant Dis. Reptr*, xxii, 19, pp. 380–382, 1938. [Mimeographed.]

True rust of cotton (*Puccinia schedonnardi*) [*R.A.M.*, xiv, p. 629] was unusually prevalent in southern Arizona in 1938, causing an estimated incidence of infection of 50 per cent. in certain areas. Outbreaks of the disease invariably start in the south and progress northwards. Poorly irrigated crops growing at slight elevations, as well as plants in an unthrifty and woody condition, are liable to escape infection. The chief spread of the disease occurs from 1st July to 1st August, after the commencement of the summer rains, the basidiospores transported by air germinating and producing infection only in the presence of sufficient moisture on the susceptible organs of the plants. The alternate grass hosts of *P. schedonnardi*, *Sporobolus* and *Muhlenbergia* spp., occur in the mountainous regions adjacent to the Santa Cruz cotton districts, and probably also in those of northern Mexico, but have not yet been observed in the rusted fields themselves.

Loewenthal (L. J. A.). **Diseases of the skin in negroes. IX–XIV. Fungi and fungous diseases.**—*J. trop. Med.* (*Hyg.*), xl, 24, pp. 324–327, 1937; xli, 2, pp. 21–26; 3, pp. 41–45; 4, pp. 58–64; 11, pp. 187–189, 1938; xlii, 2, pp. 20–25; 3, pp. 36–38; 4, pp. 53–57, 37 figs., 1939.

This is an informative, fully documented survey of the symptomatology, etiology, diagnosis, distribution, therapy, and other features of interest in connexion with fungal diseases of the skin in negroes.

DOWDING (ELEANOR S.) & ORR (H.). **The dermatophyte Microsporum lanosum.**—*Mycologia*, xxxi, 1, pp. 76–92, 25 figs., 4 graphs, 1939.

After stating that *Microsporon lanosum* [*R.A.M.*, xvii, p. 818] when producing non-inflammatory lesions may be clinically indistinguishable from *M. audouini* [ibid., xvii, p. 746; xviii, p. 177], the authors describe a mycological study made of a long-spored and a short-spored strain of the former isolated in Canada from two patients showing the same clinical type of ringworm. The microconidia were produced most abundantly in wet cultures, were released by the dissolution of the conidiophores, and collected in the moisture exuded by the aerial mycelium; they are evidently 'slime' spores [Mason's Annotated list: ii, Fasc. 3, 1937]. The macroconidia were set free by the rupture of certain cells termed abscission cells, and collected in the form of a powdery deposit over the surface of the culture; these were clearly 'dry' spores [loc. cit.]. The spore deposit became overgrown by a white, sheet-like secondary (usually termed pleomorphic) mycelium composed of narrow, almost sterile hyphae with characteristic thickenings in the form of thin plates or rings of irregular outline. While still young, the secondary mycelium could be restored to its original condition by transfer to fresh medium. Owing probably to uneven thickness of the cell walls the secondary mycelium readily fragmented into short lengths when mounted in water. Observations on 20-day-old cultures indicated that it usually originated from the base of the abscission cell after the spores were shed. A narrow hypha normally grew out through the plugged perforation of each bulging terminal septum. Formation of the secondary mycelium was induced experimentally by wounding the primary mycelium before the formation of the macroconidia.

GRIGORAKI (L.) & DAVID (R.). **Caractères biochimiques du Microsporum canis (Bodin, 1897), Grigoraki et Guiart emend. 1928.** [Biochemical characters of *Microsporum canis* (Bodin, 1897), Grigoraki & Guiart emend. 1928.]—*C.R. Soc. Biol., Paris*, cxxx, 3, pp. 203–205, 1939.

Continuing their studies on the biochemical characters of the dermatophytes [*R.A.M.*, xvii, p. 818], the writers found that *Microsporon canis* [ibid., xvii, p. 819] acts powerfully and rapidly on casein at 20° C., the dissolution of which in sterilized skimmed milk commences on the third and proceeds until the 50th day, and on gelatine at the same temperature, liquefaction beginning on the second day and reaching a maximum on the 20th. The colours of the colonies (Klincksieck and Valette) after 30 days at 35° in the presence of mannose, glucose, galactose, maltose, saccharose, lactose, inulin, dextrin, and glycerine (15 c.c. per tube and a dozen drops of sterilized litmus) were orange-yellow 178D, orange 128D, reddish-orange 61, purplish-red 581, purplish-red 592, reddish-orange 78D, purplish-red 591, red 28D, and red 36, respectively.

MACKEE (G. M.) & LEWIS (G. M.). **Dandruff and seborrhea. I. Flora of 'normal' and diseased scalps.**—*J. invest. Derm.*, i, 2, pp. 131–139, 1938.

In this study (in which the writers were assisted by Martha J. Spence

and Mary E. Hopper) of the scalp flora of 100 patients in New York City, *Pityrosporon ovale* [*R.A.M.*, xvii, p. 597] was found to be present on 70 per cent. of the normal scalps and on 66 per cent. of those showing a concomitant skin disease. In the dry or oily, scaly scalps (with or without alopecia) the percentage incidence was almost uniformly 100.

MacKee (G. M.), Lewis (G. M.), Pinkerton (M. Elizabeth), & Hopper (Mary E.). **Dandruff and seborrhea. II. Flora of the face, and further studies on the flora of the scalp.**—*J. invest. Derm.*, ii, 1, pp. 31–41, 1939.

Pityrosporon ovale [see preceding abstract] was isolated from scrapings from the skin of the face and scalp in 52 per cent. of the 133 patients examined at the New York Post-Graduate Medical School, Columbia University.

Dickson (E. C.). **Primary coccidioidomycosis. The initial acute infection which results in coccidioidal granuloma.**—*Amer. Rev. Tuberc.*, xxxviii, 6, pp. 722–729, 1938.

The writer's observations on the origin and course of the primary phase of coccidioidomycosis (*Coccidioides*) [*immitis*] in the San Joaquin Valley of California have already been noticed from another source [*R.A.M.*, xviii, p. 179].

Epstein (N. N.) & Levin (E. A.). **Favus infection. Report of a case from California.**—*Urol. cutan. Rev.*, xlii, 7, pp. 515–517, 4 figs., 1938.

Clinical details are given of a case of favus in California in a 20-year-old girl of Russian–Jewish origin, who had been under observation for the previous six years, during which time the eruption gradually changed its appearance from discrete, scaly patches scattered over the scalp and suggestive of psoriasis or seborrhoeic dermatitis to the typical scutula formation with permanent alopecia and scarring associated with true favus. Onychomycosis was also present in the later stages. *Achorion schoenleini* was consistently isolated from the lesions on Sabouraud's media and gave rise to light brown, leathery colonies with chlamydospores and favic 'candelabra'.

Cavallero (C.). **Fenomeni di variazione e di dissociazione nei miceti lievitiformi.** [Variation and dissociation phenomena in the yeast-like fungi.]—*Mycopathologia*, i, 4, pp. 227–266, 3 pls., 1939. [English and German summaries.]

After reviewing previous investigations on variation and dissociation phenomena in yeast-like fungi, the author gives an exhaustive account of his studies made in this connexion with ten strains of *Mycotorula* [*Candida*] *albicans* [*R.A.M.*, xvii, pp. 676, 817; xviii, p. 253]. In culture, *C. albicans* gave rise to smooth and rough colonies differing in their morphological and biochemical characters, pathogenicity, and aspecific agglutinability. When the smooth strains were grown under unfavourable, and the rough ones under favourable, nutritive conditions some of the strains in each series developed smooth and rough colonies side by side, accompanied, irregularly, by changes in other

characters. Some strains showed variation phenomena independently of macroscopic cultural modifications towards the smooth or rough form. Dissociation was sometimes preceded by a striking polymorphism of the yeast cells. Intermediate forms occurred showing the characters of both the rough and smooth forms simultaneously. Dissociation was also induced by passage through laboratory animals. The author concludes that dissociation in the asporogenous yeasts is a reaction by the fungus to environmental factors; under unfavourable conditions, the fungus produces a preponderance of 'resistance forms', such as mycelium and chlamydospores, with the result that it tends to develop the R phase, while under favourable conditions, blastospores, characteristic of the S phase, are produced.

Croft (C. C.) & Black (L. A.). **Biochemical and morphologic methods for the isolation and identification of yeastlike fungi.**—*J. Lab. clin. Med.*, xxiii, 12, pp. 1248–1258, 1938.

The authors describe studies on methods for culturing yeast-like fungi and the significance of certain cultural criteria in their identification. On the basis of the results obtained, supplemented by morphological criteria, it was possible to separate yeast-like fungi into genera and in some cases into species. Nine of the 13 strains isolated from pathogenic conditions (mostly in sanatorium patients) were identified as *Monilia* [*Candida*] *albicans* [see preceding abstract], which gave the most consistent fermentation results of any of the cultures studied, producing acid and gas in dextrose, levulose, mannose, and maltose, and acid in saccharose, galactose, and dextrin.

Verona (O.) & Ciferri (R.). **Mycotorula albicans associated with a disease of Carrot.**—*Mycopathologia*, 1, 4, p. 273, 1939.

The authors report the occasional isolation of a normal strain of *Mycotorula* [*Candida*] *albicans* [see preceding abstracts] from rotted carrots naturally infected with *Sclerotinia sclerotiorum* and *Bacillus carotovorus* [*Erwinia carotovora*] in Italy.

Giordano (A.). **Studio micologico del Debaryomyces neoformans (Sanfelice) Red., Cif. et Giord. e significato della specie nella patologia animale.** [A mycological study of *Debaryomyces neoformans* (Sanfelice) Red., Cif. & Giord. and of the significance of the species in animal pathology.]—*Mycopathologia*, i, 4, pp. 274–304, 2 pl., 1939. [English summary.]

After briefly reviewing previous taxonomic studies which led to the establishment of *Debaryomyces neoformans* [*R.A.M.*, xvi, p. 534; xvii, p. 111; xviii, p. 29], the author gives a detailed account of cultural, morphological, biochemical, and biological investigations into 28 strains of the organism in culture under several binomials. From the results of his study the author lists 68 species as synonyms, including *Torula histolytica*, *Torulopsis hominis*, *Cryptococcus hondurianus* [ibid., xiii, p. 162], *C. psichrofilicus* [ibid., xvi, p. 534], *T. hominis* var. *honduriana*, *T. neoformans* [cf. ibid., xvi, p. 254], *T. meningitidis*, *C. gotoi* [ibid., xvi, p. 534], and *D. hominis* [ibid., xv, p. 802]. *D. neoformans* var.

sheppei [ibid., xiv, p. 694] and *D. neoformans* var. *nasalis* [loc. cit.] are recognized as distinct from the type species.

The fungus is described as having globose or subglobose, occasionally ovate or elliptical blastospores, 3 to 11 (mostly 7 to 11), occasionally up to 18μ, in diameter. In some strains uni-, occasionally bi-spored asci develop parthenogenetically. The spherical ascospores are generally smooth, and sometimes have an undulating verrucose epispore. Germination takes place with the formation of a short germ-tube resembling a blastospore. Traces are present of the conjunction of isogamous gametes; the asci dehisce through the fracture of the wall, and the empty walls are visible in old cultures. Biochemical activity is very slight; glucose, levulose, mannose, and saccharose, but not maltose, are assimilated with the formation of acid; gelatine is not liquefied.

When inoculated into laboratory animals all 28 strains produced morphologically identical lesions. All were pathogenic, but specific granulomatic lesions were produced only in the meningeal and cerebral tissues of rats, these lesions being analogous to those observed in man.

MAGRUDER (G.). **A report of three cases of Torula infection of the central nervous system.**—*J. Lab. clin. Med.*, xxiv, 5, pp. 495–499, 1939.

Full clinical details are given of three cases (two in coloured women and one in a white man) of infection of the central nervous system by *Torula histolytica* [*Debaryomyces neoformans*: see preceding abstract] investigated at the University of Virginia Hospital in 1936 and 1937, and bringing the total to 66.

ITZEROTT (DOROTHEA). **Ein Fütterungsversuch an Meerschweinchen mit Maisbrandsporen.** [A feeding experiment with spores of Maize smut on Guinea-pigs.]—*Z. PflKrankh.*, xlix, 1, pp. 40–41, 1939.

Feeding experiments with maize straw contaminated with smut [*Ustilago zeae*: *R.A.M.*, xviii, p. 18] are described. Guinea-pigs carrying young were given for six to eight weeks a daily ration of either 0·2 gm. old or 0·3 gm. fresh smut spores mixed with their food, and in all cases a normal litter was born. It is probable that cows and horses are similarly not affected by the smut.

OCFEMIA (G. O.) & CELINO (M. S.). **Transmission of Abacá mosaic.**—*Philipp. Agric.*, xxvii, 7, pp. 593–598, 1938.

In Davao, Philippine Islands, mosaic disease of abacá (*Musa textilis*) [*R.A.M.*, xviii, p. 256] may, it is considered, if further spread is not arrested, become as serious from an economic point of view as bunchy top [loc. cit.]. In August, 1937, fully 50 per cent. of the plants were affected in some localities.

In transmission experiments in 1937–8, *Pentalonia nigronervosa* failed to transmit the disease, but successful transmission was obtained in all tests with two [unnamed] species of aphids found on abacá and banana. Transmission was also effected when the wounded surface of the midrib of a diseased abacá plant was allowed to remain in contact with the wounded surface of the midrib of a healthy one for 28 days, but inoculations by pin-pricks and sap injection were inconclusive. When cotton aphids (*Aphis gossypii*) were allowed to feed for two weeks on a

mosaic abacá plant and then transferred to a healthy abacá seedling, mosaic symptoms developed after 18 days. Similar results were obtained in a further test with three other healthy abacá seedlings in 15 to 22 days, while in another test mosaic symptoms were induced by infective *A. gossypii* on abacá plants in 24 days and on wild *Canna* plants in 18 days.

In the aphid transmission experiments, the first symptom consisted in light-coloured, dot-like areas, $\frac{1}{2}$ to 1 mm. in diameter, on the first leaf to unfurl after the insects had been allowed to feed. These yellow areas expanded very rapidly until arrested by the veins, and formed oblong, discoloured areas, from 3 to 15 mm. (or even to the leaf margin) by 1 to $1\frac{1}{2}$ mm., the site of the original spot remaining distinct in all cases. On the succeeding leaves the symptoms gradually became more marked, until the whole foliage sometimes turned yellow. The symptoms on wild *Canna* were virtually the same, though the streaks appeared about 20 days after the first symptoms.

Lopatin (V. I.). Болезни Люцерны и меры борьбы с ними. [Diseases of Lucerne and their control.]—*Socialistic Grain Fmg, Saratoff, 1938*, 2, pp. 110–128, 13 figs., 1938.

The extensive spread and frequent severity of lucerne rust (*Uromyces striatus*) [see above, p. 375] in the German S.S.R. of the Volga, as well as on the left bank of the middle reaches of that river, is attributed by the author chiefly to the abundance in those regions of highly susceptible species of *Euphorbia*, i.e., *E. virgata*, *E. uralensis*, and possibly *E. esula*. Even in 1936, when conditions were exceptionally dry and hot, rust infection in irrigated lucerne fields was as high as 32·6 per cent., though slight to very slight elsewhere; in 1937, which was marked by wet and cool conditions during the later part of the spring, the percentage of infection attained 89·3 in the irrigated, and 80·3 in the non-irrigated areas; in dry-cultivated fields, however, which had been free from rust in 1936, infection fell to 12·9 per cent. on the Ukrainian 229 variety and to 1·94 per cent. on the local [unnamed] variety. The effect of density of lucerne stands on the spread of rust from infected *Euphorbia* plants was well illustrated by the fact that in the thinner stands of 1936 infection was still 10·7 per cent. at a distance of 0·8 to 1 m. from the source of infection, while in the dense stands of 1937 no infection was noted at a distance of 0·5 m. Evidence is further adduced showing that in fields only slightly attacked, the percentage infection rose to 50 on plants that had been mechanically injured during cultivation. Preliminary observations on rust resistance indicated that varieties native to Asia Minor and Central Asia are highly susceptible, while certain samples received from Canada and the United States were highly resistant. Certain ecological types from east China (Yangi-Shar and Kashgar) were also very resistant, and might be used in hybridization work for rust resistance.

The other lucerne diseases in the regions studied in the two years are stated to be: brown spot (*Pseudopeziza medicaginis*) [*R.A.M.*, xvii, p. 325], leaf spots caused by *Cercospora medicaginis* [ibid., ix, p. 319], *Ascochyta pisi* [ibid., xvii, p. 831], *Leptothyrium coronatum* (a new record for the region), *Phyllosticta medicaginis* [ibid., xiii, p. 32], and *Guignardia*

sp.; downy mildew (*Peronospora aestivalis* [or *P. trifoliorum*; ibid., xi, p. 304]); black stem spot (*Sphaerella circumvaga*), *Corticium vagum* [*C. solani*], and a black leaf spot caused by an unidentified fungus, which is stated to induce heavy defoliation in affected stands.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, l, 2, pp. 87–90, 1939.

In several districts in the west of New South Wales during 1937–8 lucerne stands developed vast unhealthy patches in which individual plants turned yellow and died, the crown and root tissues rotting and having a shredded, greyish appearance. Both two-year-old stands and others established for several years were affected, the diseased areas being more prevalent on light than heavy soils. It was ascertained that the chief factor inducing the trouble was over-stocking in an exceptionally dry season, with consequent weakening, and resultant infection by *Rhizoctonia bataticola* [*Macrophomina phaseoli*: *R.A.M.*, vii, p. 674].

Black rot of stocks [*Matthiola incana* var. *annua*], attributed to a strain of *Bacterium campestre* [*Pseudomonas campestris*: ibid., xviii, p. 256], is stated to have caused a loss of 12,000 seedlings in one nursery alone. The control methods suggested consist in the selection of clean seed, steeping for 10 minutes in mercuric chloride ($\frac{1}{4}$ oz. to $12\frac{1}{2}$ pints of water), soil disinfection with formalin (1 in 50) a few weeks before sowing, planting out the seedlings on clean areas, crop rotation, and the destruction of diseased plants.

Wormald (H.). **Diseases of Fruits and Hops.**—290 pp., 40 pl., 24 figs., London, Crosby Lockwood & Son, Ltd., 1939. 17*s*. 6*d*.

This well illustrated book is written mainly for growers, but intended to be of use also to students and advisers in horticulture. After preliminary chapters dealing with factors conducive to health or disease in plants, fungicides and their application, and certain diseases affecting several different hosts, the author gives an account in semi-popular terms of the diseases of fruit trees (including walnut and cob nut [*Corylus avellana*]) and hops in Great Britain. Symptoms and control measures are stressed, but brief descriptions are given of the parasites and their habits. A final chapter is devoted to some of the more important diseases of fruit trees not yet recorded in this country.

Banga (O.). **Handleiding voor het herkennen van eenige nietparasitaire ziekten en beschadigingen van Appels.** [A guide to the recognition of some non-parasitic diseases and injuries of Apples.]—*Meded. Lab. Tuinbouwpl., Wageningen*, 31, 49 pp., 29 figs., 1938.

In this useful guide the non-parasitic disorders of apples [cf. *R.A.M.*, xviii, pp. 116–119) under discussion are divided into six groups, viz., (I) diseases and injuries induced by climatic influences during vegetation, including water-core; (II) boron deficiency; (III) pitting; (IV) physiological disturbances after picking, practically restricted to the skin, e.g., scald, lenticel scald, Gravenstein spot scald, and Jonathan spot; (V) brown discoloration of the flesh during storage, including low temperature or soggy breakdown, of which soft or deep scald is a special form, brown heart, and Jonathan breakdown; and (VI) injuries due

to chemicals or gases. The symptoms, etiology, predisposing factors, and possibilities of control are briefly described in connexion with the various diseases, and a bibliography of the relevant literature is appended to each section.

SCHMIDT (M.). **Venturia inaequalis (Cooke) Aderhold. VIII. Weitere Untersuchungen zur Züchtung schorfwiderstandsfähiger Apfelsorten. (Erste Mitteilung.)** [*Venturia inaequalis* (Cooke) Aderhold. VIII. Further investigations on breeding scab-resistant varieties of Apples. (First note.)]—*Züchter*, x, 9–11, pp. 280–291, 6 figs., 1938.

In this contribution to his studies on apple scab (*Venturia inaequalis*) [*R.A.M.*, xvi, p. 617] the author describes the results of six years' observations on the resistance to scab of 31 species or hybrids of *Malus* [*Pyrus*] grown at Müncheberg, Mark Brandenburg, Germany. In the field no infection occurred on *M.* [*P.*] *coronaria* or *M.* [*P.*] *micromalus*, and little on *M.* [*P.*] *spectabilis*, *M.* [*P.*] *zumi*, *M. ioensis* var. *plena*, *M. lancifolia*, and *M. hartwigii*. In other field tests resistance was found in 20 seedlings out of 887 from open-pollinated species of *Pyrus*, in 8 out of 901 crosses between *Pyrus* spp., 4 out of 3,873 crosses between *Pyrus* forms and cultivated apple varieties, and 1 seedling of Landsberg Pippin (No. V, 9, 18) out of 21,616 from open-pollinated cultivated varieties; most of these seedlings proved to be resistant under conditions of artificial infection to populations of the fungus from five different origins. The majority, however, bore small fruits with a high tannin content. Of the Müncheberg collection of apples Stein Antonovka showed no infection at all, Antonovka Kamenitzka only a little, and Ernst Bosch was relatively less susceptible than most of the other varieties.

In further work one-year-old seedlings were tested by inoculations on individual plants or in the mass. The latter method consisted in sprinkling the seedlings in a whole row of seed-beds with a suspension of conidia, covering the beds with cloth, and keeping them moist for three or four days. In the first series of experiments 14 out of 178 seedlings from crosses between open-pollinated *Pyrus* spp. and cultivated varieties were found to be resistant, all of them having *M. baccata* var. *himalaica* (No. V, 35, 16) (found to be resistant in the field) as one of the parents. In a further series the progenies of the *P. micromalus* × Charlamowsky (No. II*b*, 7, 32) gave the best results, showing 18 resistant seedlings among the 40 tested. Of 1,638 progenies of Antonovka tested 163 were resistant, and of 168 progenies of Ernst Bosch six. A general survey of the results showed that the highest percentage of resistant forms (4·1 per cent.) was among the progenies of *P.* spp. and their hybrids, 2·6 per cent. among the crosses between *P.* spp. and cultivated varieties, and 1·9 per cent. among the back-crosses of the hybrids of *P.* spp. × cultivated varieties to cultivated varieties.

HILDEBRAND (E. M.). **Studies on fire-blight ooze.**—*Phytopathology*, xxix, 2, pp. 142–155, 4 figs., 1939.

Virulent cultures of the causal organism of fireblight (*Erwinia amylovora*) [*R.A.M.*, xvii, pp. 535, 660; xviii, p. 36] were recovered

from various samples of dried natural exudate collected in the orchard [? at Cornell, New York] on Northern Spy apples and several pear varieties after periods ranging from 15 to 25 months, whereas in pure culture the pathogen does not ordinarily survive desiccation even for one.

The material used in most of these studies was obtained by the aseptic inoculation of green pear fruits, each of which yielded about 1 c.c. moist exudate, turbid at first but tending to clear with advancing age and rapid death of the bacteria. The survival of the latter for more than a fortnight (a maximum of five months in these tests) in their natural matrix necessitates prompt drying (within a week of collection). The colour of the exudate is a uniform cinnamon-rufous-brown. Chemical analyses showed that a sugar identified as dextrose comprises 31 per cent. of the dry substance in the matrix. The thermal death point of the bacteria contained in pear exudate was found to be lower by about 5° C. than that of the organisms grown on agar or in broth. In its natural matrix *E. amylovora* was also more sensitive to the action of bactericides than on culture media. Cultures of the organism on a synthetic carbohydrate medium were able to utilize the dilute sterile exudate as a source of carbon. The fireblight bacteria stain unevenly with carbol fuchsin when embedded in their natural matrix; they were shown by this means to be surrounded by a capsule-like sheath removable by high-speed centrifuging in water or physiological salt solution.

Dilute fireblight exudate with an osmotic pressure of 1·61 atmospheres induced wilting of pear shoots and cellular plasmolysis, whereas in pure sucrose solutions osmotic pressures of 15·62 atmospheres and upwards were required to bring about similar effects, indicating the operation in the exudate of some factor other than osmotic pressure. Wilting developed in cut pear shoots immersed in sterile exudate matrix, pointing to the presence of a toxin. The wilting was accompanied by necrosis of the cut ends and plasmolysis of the cells in the lower portions of the stem. The toxic substance of the exudate is thermostable, withstanding steam heat for several hours and three months in the dry-air oven at 100° C, but its exact identity remains to be determined.

MOORE (W. C.). **New and interesting plant diseases. I.**—*Trans. Brit. mycol. Soc.*, xxii, 3–4, pp. 264–267, 1 pl., 1939.

The angular spot disease of apples observed in 1937 at Lingfield, Surrey [*R.A.M.*, xvii, p. 373] is attributed to *Phyllosticta angulata* on the basis of careful comparison of the English material with that collected in Austria by Wenzl [ibid., xv, p. 814]. The constant association of the fungus with these very angular spots strongly suggests that it is the cause of the disease, but no confirmatory experiments have yet been carried out. On the host the pycnidia were 90 to 170 μ in diameter, the unicellular, hyaline spores measuring 6 to 8 by 3 to 4 μ. Monospore isolations on malt agar gave a whitish-grey to buff-coloured felt of mycelium with relatively abundant pycnidia, the larger of which were up to 280 μ in diameter, and with rather longer and broader spores measuring 5 to 9 by 4 to 6 μ.

Haplobasidium pavoninum was isolated from the conspicuous, irregularly shaped, buff-coloured blotches, about ¼ to 1 in. across, spreading inwards from the margins of the leaves of a seedling *Aquilegia* from a garden at St. Keverne, Cornwall. Some of the leaflets were killed and in others a well-marked purplish band indicated the boundary between the healthy and diseased parts. The conidiophores emerging through the cuticle were simple, smoke-grey, 24 to 45 μ long and 4 to 7 μ broad at the base, swelling above to a rounded, flattened head 11 to 15 μ across, on which 1 to 4 (mostly 3) sterigma-like cells, measuring 15 to 18 by 5 to 6 μ, were borne. The conidia were formed in short chains on the sterigma-like cells or directly on the head of the conidiophore and were spherical or ellipsoidal, hyaline at first, then greyish-brown, 7 to 11 by 6 to 9 μ, with a clearly defined wall ½ μ thick.

Bucksteeg (W.). **Über die Monilia-Anfälligkeit unserer Obstsorten.** [On the susceptibility of our fruit varieties to *Monilia*.]—*Z. PflKrankh.*, xlix, 1, pp. 11–15, 1939.

The author gives a list of 47 varieties of cherry, 46 of apple, and 51 of pear classified according to their reaction to *Monilia* [*Sclerotinia* spp.]. The resistant cherry varieties include Beste Werder, Excellenz von Hindenburg, Flametin, Grosse Prinzessin, Hedelfinger Riesen, Jaboulay, Kassin's Frühe, Königliche Amarelle, La Poitevine, Liefeld's Braune, Lübeck Wein, Schöne von Montreuil, and Wils' Frühe Herz; and the resistant apple varieties Ananas Renette, Baumann's Renette, Echter Winterstreifling, Gelber Bellefleur, Glanz-Renette, Grosser Bohnapfel, Grüner Winter Stettin, Jakob Lebel, Nathusius' Taubenapfel, Parker's Pippin Sommer-Zimtapfel, and Roter Trierischer Weinapfel. The list of resistant pear varieties is based solely on observations by Klöck in 1910 (*Z. landw. VersWes. Öst.*, xiv, 3, 1911).

Gonçalves (R. D.). **A sarna e a podridão parda do Pessegueiro.** [Scab and brown rot of the Peach.]—*Biologico*, v, 1, pp. 17–18, 1939.

Popular notes are given on two widespread and destructive diseases of peaches in Brazil, namely, scab (*Cladosporium carpophilum*) and brown rot (*Sclerotinia cinerea*) [*S. laxa*], with directions for their control by appropriate cultural measures and the application of a standard spray schedule.

Hildebrand (E. M.) & Palmiter (D. H.). **Yellow-red virosis (X-disease) of Peach and Chokecherry.**—*Plant Dis. Reptr*, xxii, 20, pp. 394–396, 1 map, 1938. [Mimeographed.]

Further details are given concerning the distribution of X-disease of peaches (for which the name of yellow-red virosis is now suggested as more descriptive) in New York [*R.A.M.*, xviii, p. 38]. Infected peach orchards have been definitely observed in Columbia, Greene, and Dutchess counties and are believed to be present also in Rensselaer and Albany, while diseased chokecherries (*Prunus virginiana*) have been detected in about 20 other counties, including some in the west and central sections of the State where the bulk of the peaches are grown. The yellow-red virosis is believed to have been present in the Hudson Valley for some time, possibly as long as four years. Particulars

are given of its rapid spread in two peach orchards, in which recent counts disclosed 65 and 41 per cent. infection, respectively. *P. virginiana* has further been observed by Prof. Whetzel to show symptoms of the disease in Vermont, while material of the western chokecherry (*P. demissa*) from Utah was similarly affected. The typical features of yellow-red virosis are also reported on an isolated peach tree in Colorado.

BAUER (R.). **Die Methode der Masseninfektion bei der Züchtung meltau- und blattfallresistenter Rassentypen bei der Gattung Ribes.** [The mass infection method in the breeding of mildew- and leaf fall-resistant race types in the genus *Ribes*.]—*Forschungsdienst*, vi, 12, pp. 575–584, 3 figs., 1938.

Particulars are given of a combined mass infection method (by spraying with spore suspensions under controlled conditions) permitting the simultaneous greenhouse testing of *Ribes* spp. for resistance to mildew (*Sphaerotheca mors-uvae*) and leaf fall (*Gloeosporium ribis*) [*Pseudopeziza ribis*]. The process occupies a period of three to four weeks and facilitates the selection of individuals resistant to either or both of the diseases in question.

RIETSEMA (I.). **Oplossing van het mozaïek-vraagstuk bij de Frambozen.** [Solution of the mosaic problem in Raspberries.]—*Landbouwk. Tijdschr., Wageningen*, li, 620, pp. 14–25, 1939. [English summary.]

The writer describes further promising steps in his programme for the development of mosaic-resistant raspberries in Holland [*R.A.M.*, xvi, p. 475] by the protracted selfing of healthy seedlings of desirable varieties coupled with judicious crossing with 112 or Pyne-Royal and Haagsche Bruine or Lloyd George to avoid a weak habit of growth. The extended application of these methods should bring the mosaic problem well within sight of solution.

EDWARDS (W. D.) & ZELLER (S. M.). **Insect pests and diseases of Strawberry in Oregon.**—*Bull. Ore. agric. Exp. Sta.* 357, 30 pp., 19 figs., 1938.

Popular notes are given on the following diseases affecting the Oregon strawberry crop: crinkle [*R.A.M.*, xiii, p. 313; xviii, p. 326], to which the Redheart variety is resistant; yellows [? xanthosis: ibid., xviii, p. 191]; witches' broom [ibid., viii, p. 295]; leaf spot (*Mycosphaerella fragariae*: ibid., xviii, p. 191]; scorch (*Diplocarpon earliana*) [loc. cit.] and leaf blight (*Dendrophoma obscurans*) [ibid., x, p. 254]; mildew [*Sphaerotheca humuli*: ibid., xviii, p. 191]; crown rot (*Armillaria*) [*mellea*: ibid., xi, p. 727]; root rots (*Rhizoctonia* [ibid., xvi, p. 822] and *Verticillium* [ibid., xvii, p. 689]); and fruit rots, chiefly grey mould (*Botrytis*) [*cinerea*: ibid., xviii, p. 191].

WILCOX (MARGUERITE S.). **Phomopsis twig blight of Blueberry.**—*Phytopathology*, xxix, 2, pp. 136–142, 2 figs., 1939.

Young, succulent blueberry (*Vaccinium corymbosum*) shoots reacted positively to greenhouse inoculations both with a *Phomopsis* isolated from diseased material of the same host in Massachusetts and with

P. (*Diaporthe*) *vaccinii* from decayed cranberry fruits [*R.A.M.*, xi, p. 188], no matter whether the inoculations were carried out with spore suspensions or with mycelium on wounded and unwounded tissues. The organisms gain ingress near the shoot tips and proceed downwards, at an average rate of 5·5 cm. in two months, eventually girdling the old branches and killing the part above. Direct inoculation of the woody tissues results in the formation of localized lesions only. Foliar spots bearing pycnidia developed at a relatively low temperature in the partial shade of a lath house, but not under normal greenhouse conditions. Pycnidia have also occasionally been found on dead twigs of Pioneer, Cabot, Wareham, Rubel, Rubel × Chatsworth, and Rubel × Haines in Massachusetts, and on Rancocas and Rubel in New Jersey. The disease has further been reported from North Carolina.

No essential differences were detected between the blueberry *Phomopsis* (which must not be confused with a species of the same genus causing crown and stem galls [ibid., xvii, p. 403]) and *D. vaccinii* in cultures on Thaxter's, beef, strawberry, maize meal, and potato dextrose agars at 10°, 18°, and 25° C. The pycnospores of both strains measured 6 to 11 by 2 to 5 μ and scolecospores were abundantly produced on certain media. The blueberry *Phomopsis* is considered, on the basis of these results, to be identical with *P.* (*D.*) *vaccinii* from cranberry.

WILSON (J. D.) & RUNNELS (H. A.). **Influence of residue color of Bordeaux mixture on transpiration in sun and shade.**—*Bi-m. Bull. Ohio agric. Exp. Sta.*, xxiii, pp. 129–138, 1 graph, 1938.

In further experiments on the effect of Bordeaux mixtures on the transpiration of plants [*R.A.M.*, xiv, p. 708] the authors studied the relation of spray residues of different reflective capacity to the transpiration rate in sun and shade. Tests were made on *Coleus*, tomato, potato, tobacco, and cucumber plants sprayed with Bordeaux mixtures of the following formulae: 4–4–50, 4–12–50, and 4–4–50 plus lampblack (4 lb.). Leaf temperature determinations showed the leaves of all plants to be warmer than the air when in full sunlight; those treated with the 4–12–50 mixture (with a light-coloured, opaque residue) were cooler, and those treated with the lampblack mixture warmer than the untreated ones, while the 4–4–50 residue had little effect on leaf temperature. The leaves of plants in the shade were usually slightly cooler than the air, except those sprayed with the lampblack mixture, and from 2° to 5° C. cooler than comparable ones in the sun. In the greenhouse, where the radiant energy factor was only about half as much as in full sunlight, transpiration was decreased by the residues from a 3–4½–50 and a 3–9–50 Bordeaux mixture but increased by a 3–4½–50 plus 3 lb. lampblack, between the hours of 10 a.m. and 4 p.m., the effect of lampblack on transpiration being at a maximum during the period of maximum sunlight intensity (from 10 a.m. to 1 p.m.). The lampblack mixture caused a greater increase in the transpiration rate of plants in full sunshine than in the shade, whereas the 4–12–50 mixture caused plants to lose less water in full sunshine than any of the other groups.

Data from 14 trials with *Coleus* and 10 with tomatoes showed that the plants in the shade lose approximately 60 per cent. as much water

as those in full sunlight. Cutting off two-thirds of the radiant energy by shade reduced the average transpiration rates in the sun for plants sprayed with the 4–4–50, 4–12–50, and the lampblack mixtures, and for untreated plants by about 40, 39, 40, and 42 per cent., respectively.

DODGE (B. O.). **The ascocarp and ascospore formation in Stevensea wrightii.**—*Mycologia*, xxxi, 1, pp. 96–108, 2 figs., 1939.

In an introductory paragraph to this paper the author states that he observed a very rapid, somewhat soft rot on segments of *Opuntia amophila* recently received from Florida. Within a week after the first appearance of the spots the segments had become thoroughly rotted, and hundreds of pustules were breaking through the surface and forming masses of crescent-shaped, uniseptate spores. Both the symptoms and the spore characters agreed with *Gloeosporium lunatum* (*Mycosphaerella opuntiae*) [ibid., v, p. 303]. No other disease of *Opuntia* studied by the author has so rapidly destroyed the segment.

The same material also bore spots containing the coal-black fruit bodies of a fungus referred to *Stevensea wrightii* (syn. *Perisporium wrightii*), previously studied by Wolf (*Ann. mycol., Berl.*, x, pp. 113–114, 1912). Cytological studies on this fungus are described in detail.

SUIT (R. F.) & HORSFALL (J. G.). **A simple method of measuring the interfacial friction of dusted seeds.**—*Phytopathology*, xxix, 2, pp. 200–204, 1938.

A simple but reliable method of measuring the interfacial friction of dusted seeds is described. A ½ in. wooden plunger is thrust into a 300 c.c. tall beaker full of seeds (250 gm. of peas or wheat, 84 gm. beet) sitting on a spring-type platform household scales reading up to 24 lb., and the interfacial friction measured in pounds pressure required to push the plunger 3 in. into the seed by the indicator needle. The accumulated data of nine months revealed a marked increase of interfacial friction in peas from the addition of equal dosages of red copper oxide, 2 per cent. ethyl mercury chloride, and ethyl mercury phosphate (new improved ceresan). Both dusted and non-dusted Wilt Resistant Perfection peas showed more interfacial friction than Wisconsin Early Sweet. Flake graphite [*R.A.M.*, xvi, p. 720] of 325 mesh more effectively reduced the interfacial friction than amorphous graphite of the same particle size. Copper carbonate caused a greater increase in interfacial friction of Forward wheat seeds than red copper oxide, while a 30 per cent. rise followed the use even of the low concentration of new improved ceresan recommended for this cereal. Red copper oxide, semesan, and zinc oxide enhanced the degree of interfacial friction in beet seed; in the case of the first-named a slight reduction was effected by the incorporation of graphite with the dust.

LAMBERT (E. B.). **A spore isolator combining some of the advantages of the La Rue and Keitt methods.**—*Phytopathology*, xxix, 2, pp. 212–214, 1 diag., 1939.

A single spore isolator uniting the advantages of the La Rue (*Bot. Gaz.*, lxx, pp. 319–320, 1920) and Keitt (*Phytopathology*, v, pp. 266–269, 1915) techniques is described. It consists essentially of a 'biscuit cutter',

3 to 4 mm. in diameter, mounted vertically in a threaded brass plug, screwed on the microscope instead of the objective. The cutter, after flaming, is swung by the revolving nose-piece of the microscope into position above a single spore on agar in a Petri dish, moved downwards until a circle is marked off round the spore, and then raised and swung to one side. After examination of the circled area the cutter is again swung into place and lowered sufficiently to pick up the disk of agar with the single spore. The disk can be forced out of the cutter by lowering it into sterile agar and may then be transferred by a sterile microspatula to a dish or tube.

McLean (R. C.). **Isolating fungus spores.**—*Watson's micr. Rec.*, 46, pp. 3–4, 1 fig., 1939.

The author describes two improved types of cutter plunger, attachable to the nose-piece of a microscope, for cutting out portions of agar bearing single spores. One type is fitted with a safety spring, and both are supplied with a closely fitting ramrod for pushing out the agar by air compression.

Wilkins (W. H.) & Patrick (Sheila H. M.). **The ecology of the larger fungi. III. Constancy and frequency of grassland species with special reference to soil types.**—*Ann. appl. Biol.*, xxvi, 1, pp. 25–46, 1939.

In this third contribution to the series of papers on the ecological distribution of the larger fungi [*R.A.M.*, xviii, p. 2], the authors present the data on the 172 species of fungi found during 1936–7 in 20 different grassland stations on chalk, clay, and sand soils. Detailed notes are given on the ecology of each station and the fungi found are listed with their respective frequency. The number of species found on grasslands was small compared with those in oak and beech woods; only 86 species were common to grasslands and oak woods (469 species) and 70 to grasslands and beech woods (419 species). Grasslands are regarded as one ecological type in spite of soil variation.

Ingold (C. T.). **Spore discharge in land plants.**—178 pp., 75 figs., Oxford University Press, 1939. 7*s*. 6*d*.

This is a comprehensive survey of the varied methods of spore discharge by fungi and other cryptogams. The mechanisms of discharge, which are often of a very beautiful and intricate nature, are described in detail and illustrated by numerous drawings.

Wood (Jessie I.) **Crop losses from plant diseases in the United States in 1937.**—*Plant Dis. Reptr, Suppl.* 108, pp. 95–131, 1938. [Mimeographed.]

Tables are given showing the estimated reductions from fungal, bacterial, virus, and other diseases in cereal, vegetable, fruit, cotton, and tobacco crops in the United States in 1937 [cf. *R.A.M.*, xvi, p. 826].

Bawden (F. C.). **Some recent work on plant viruses.**—*Emp. J. exp. Agric.*, vii, 25, pp. 1–10, 1939.

nature of viruses, symptoms of virus diseases, vectors, control, viruses as antigens, and the chemical nature and isolation of plant viruses.

RAYNER (M. C[HEVELEY]). **The use of soil or humus inocula in nurseries and plantations.**—*Emp. For. J.*, xvii, 2, pp. 236–243, 1938.

In September, 1937, the Imperial Forestry Institute, Oxford, sent a questionnaire to 47 representative Forestry Departments and Research Institutions in the British Empire and elsewhere inviting information on the mycorrhizal problem [cf. *R.A.M.*, xvii, p. 421] respecting the use of transported soil or humus in growing exotic trees.

Among the replies received, one from the Union of South Africa reported undeviating success with nursery and *in situ* sowings of exotic conifers always associated with satisfactory mycorrhizal development.

In India, *Casuarina equisetifolia* plants grown in inoculated soil were reported to have flourished, whereas the controls had died in three years.

In Northern Rhodesia, among *Pinus canariensis*, *P. caribaea*, *P. halepensis*, *P. pinaster*, *P. palustris*, *P. patula*, *P. taeda*, *P. teocote*, and other exotic species, it was found that only *P. halepensis* made any growth beyond the seedling stage without the addition of soil inocula. A striking stimulation of growth in nursery-beds of *P. longifolia* and experimental plots of *P. caribaea*, *P. halepensis*, and *P. taeda* followed inoculation with soil from a *P. radiata* plantation in Southern Rhodesia, but the treatment produced no visible effect in experimental plots of *P. pinea*, *P. pinaster*, *P. canariensis*, and *P. longifolia*. When nursery beds of *P. longifolia* were inoculated with soil containing mycelia and sporophores of different Hymenomycetes, after four months the untreated control seedlings and those from beds treated with soil containing the white edible mushroom 'tente' or with cow manure dug in on the surface averaged 3 in. in height, had short, discoloured needles and showed no mycorrhiza. The seedlings from beds treated with Southern Rhodesian soil averaged $5\frac{1}{2}$ in. high, had long needles of good colour, and showed copious mycorrhiza.

The Buitenzorg (Java) Forest Research Institute reported that *P. merkusii* was entirely dependent on the presence of a mycorrhizal infection for normal development. After inoculation with humus from under pine, or with roots, or with pure cultures of the mycorrhizal organism, the plants closest to the place where the inoculation was effected displayed vigorous, normal growth. After the mycorrhiza had become established, infection spread rapidly. The chief mycorrhizal fungus of *P. merkusii* is a form of *Boletus granulatus* [ibid., xvi, pp. 155, 827] or some closely related species.

Nyasaland reported positive results following soil inoculation from old thriving stands of *P. patula* and *P. radiata* on many other species in nurseries and pots. All the species observed except *P. longifolia* failed to grow without soil inoculation, as did *Araucaria cunninghamii*.

New Zealand reported positive results for *P. radiata* using inoculation of seed beds with *Boletus*-infected soil from a healthy stand, and with sporophores of *B. luteus*, *Scleroderma bovista*, and *Rhizopogon rubescens*. Mycorrhiza were absent from plants in all control plots. Reports of successful inoculation were also received from Western Australia and Queensland [ibid., xvi, pp. 155, 827].

The author considers that importance attaches to the inoculation soil or humus being in a damp condition; further, the presence of active mycorrhiza free from undesirable fungal contaminants in the inoculum should be verified in the laboratory. A technique should be standardized by which small amounts of potentially active material or sporophores of known or suspected mycorrhiza-formers can be used to 'spawn' heaps or beds of organic material to be utilized later for soil inoculation in nurseries, potting soil, or plantations. Soil inoculation should be resorted to at sowing or planting out, or, in the case of pure culture inocula, after germination, when the plants are still healthy and active. The replies received confirm the view that the same fungus may be associated beneficially with a number of different conifer species, while unable to form mycorrhiza with others. They also confirm the observation that a number of different species of fungi may form balanced associations with any one species of tree. Several such associations may be present at the same time in one tree, especially in the case of pines.

COCKERHAM (G.). **The distribution and significance of certain Potato viruses in Scotland.**—*Scot. J. Agric.*, xxii, 1, pp. 1–11, 1 map, 1939.

The maximum acreage under Majestic, King Edward, and Kerr's Pink potatoes rejected on account of leaf roll in Scotland [*R.A.M.*, xvii, p. 266] (1937 figures) occurs in the south-eastern area. The disease was a common cause of rejection in Arran Consul, Gladstone, and Dunbar Cavalier, while other highly susceptible varieties include Kerr's Pink, Great Scot, Golden Wonder, British Queen, and Up-to-Date. During the year under review, Arran Banner and Doon Star were comparatively free from infection.

Severe mosaic [ibid., xvii, p. 374] is of economic importance only in the south-west, where the locally cultivated potato varieties fall into four groups according to their reactions to viruses A and X, viz., (1) lethally necrotic to both, (2) lethally necrotic to A but not to X, (3) lethally necrotic to X but not to A, and (4) non-lethal to both. Group (1) comprises King Edward, Epicure, and Ninetyfold; (2) Kerr's Pink, Doon Star, Great Scot, Eclipse, Sharpe's Express, Redskin, Duke of York, British Queen, Up-to-Date, Gladstone, and Ballydoon; (3) may be ignored for practical purposes; (4) may be subdivided into (*a*) containing varieties commonly found to be infected by virus A, namely Golden Wonder, Arran Chief, and Catriona, and (*b*) represented by the remaining non-lethally reacting varieties, Majestic, Arran Banner, Arran Pilot, Arran Consul, Ally, May Queen, King George, Dunbar Cavalier, Arran Comrade, Arran Luxury, and Di Vernon. The rejections in groups (1), (2), (4*a*), and (4*b*) on account of severe mosaic amounted to 0·80, 0·64, 12·72, and 1·25 per cent., respectively. The incidence of the disease in the south-west was shown to amount to 7·52, 1·94, 30·74, and 6·94 per cent., respectively, for the four foregoing groups, compared with maxima of 0·50, 1·35, 14·50, and 1·14 per cent., respectively, for other parts of the country. The chief agent of severe mosaic in group (1) is virus Y, which is localized in the south-west; in group (2) it may be due to X, Y, or X+Y; in (4*a*) to A+X or A+X+Y; and in (4*b*) to A+X, A+Y, or X+Y.

The percentages of 'stock seed' (99·95 per cent. pure and containing

no diseases except negligible mottle), grade A (99·5 per cent. pure and not exceeding 1 per cent. mild and severe mosaic, leaf roll, and wildings), and H (not more than 3 per cent. severe mosaic, leaf roll, and wildings) in group (1) were 4·28, 67·96, and 26·18, respectively, the corresponding figures for (2) being 0·27, 12·10, and 72·60, and for (4*b*) 0·28, 6·58, and 85·28, respectively.

Scottish Society for Research in Plant Breeding. Report by the Director of Research to the Annual General Meeting, 21st July 1938.—22 pp., 6 figs., 1938.

The following items of phytopathological interest occur in this report. W. Black's studies on the mode of inheritance in potatoes of resistance to blight (*Phytophthora infestans*) [*R.A.M.*, xvii, p. 268 *et passim*] indicated that resistance is dominant to susceptibility. All the F_1 seedlings derived from crosses between *S*[*olanum*] *demissum* (resistant) and (1) the Alness and (2) Shamrock (both susceptible) were found to be resistant. An investigation of the botanical characters of resistant seedlings denoted that resistance is either transmitted independently or at any rate not linked with any 'wild' feature undesirable in a commercial variety.

G. Cockerham and C. A. Lyall state that further evidence is forthcoming of the existence of a dominant factor controlling a necrotic reaction in potatoes to virus X which is ultimately lethal to the host [see preceding abstract]. The positive identification of this character should prove of great value in breeding as likely to afford a means of combating the group of disorders caused by the virus and its complexes. Analytical data collected in 1937 demonstrated that the extent of mosaic in Scotland depends primarily on varietal reactions to viruses A and X, and the main object of the potato-breeding programme should therefore be the development of varieties with a necrotic response to these viruses.

Minimum periods of three and four years, respectively, have been found requisite for the assessment of varietal reaction to virus Y and leaf roll [loc. cit.] in field trials.

Seed testing and plant registration.—*Scot. J. Agric.*, xxii, 1, pp. 11–17, 1939.

The following items of phytopathological interest occur in this report [cf. *R.A.M.*, xvii, p. 374]. The following reductions in yield of 2 in. ware potatoes from an infected plant may be expected to result from the different viruses recognized in the inspection scheme: negligible mottle [= faint mottling] 20 per cent. in both Majestic and Arran Chief; mild mosaic 40 and 35 per cent., respectively; border-line severe mosaic 56 and 40 per cent., respectively; severe mosaic [see preceding abstracts] 80 and 75 per cent., respectively; and leaf roll [loc. cit.] Golden Wonder 93 per cent. ($1\frac{3}{4}$ in. ware) and Arran Consul 74 per cent. The significance of the top necrosis reaction to viruses A and X, conferring virtual immunity in the field, has now been realized, and seedling 451*a* (20), derived from a cross between Epicure and Pepo and possessing this type of response, has been placed on the register of new varieties after only two years' testing.

Net necrosis [ibid., xvii, p. 701] of Golden Wonder, Arran Consul, Kerr's Pink, and possibly other varieties appears from four years' investigations to be associated with primary leaf roll, of which, however, it is not a constant symptom, having been observed in only 91 out of 724 known cases.

Dry rot of stored potatoes (*Fusarium coeruleum*) [ibid., xvii, p. 374] was found to be negligible in pits left unopened until March, but opening at any time between November and February results in severe infection of the tubers boxed or returned to the pit after dressing. Boxing the tubers at lifting time or later promotes a higher incidence of dry rot than the conditions obtaining in the pit, especially before February. The bagging of tubers taken from the pits in December or January causes more dry rot than any other storage practice. Early varieties show an enhanced degree of susceptibility to *F. coeruleum* following bruising until December, later ones up to February or March. Practically complete control of dry rot may be effected by immersion at lifting in a 1 per cent. solution of an organic mercury compound or formalin for 1 and $\frac{1}{4}$ to $\frac{1}{2}$ minute, respectively; preparations of the former type, remaining on the surface of the tuber as a dust after drying, further assist in checking infection in storage. The small amount of dry rot occasionally developing even in thoroughly treated tubers appears from pot tests to be attributable to soil infection.

Köhler (E.). **Zur Systematik des Kartoffel-X-Virus.** [On the systematic position of the Potato X virus.]—*Naturwissenschaften*, xxvii, 9, p. 149, 1939.

Recent researches necessitate the division of the X virus of potatoes into two groups, one (X^E) comprising strains inactivated at 75° C. and the other (X^N) represented by those succumbing at 68° (heating the raw juices for ten minutes). Variability is considerable within both groups, which include very weak strains spreading slowly in tobacco, moderately active ones with a normal faculty of permeation, and very powerfully necrotic strains diffusing relatively slowly. The view that both groups belong to the same virus species (X) is upheld by the following criteria. (1) Representatives of one group may be used for protective inoculation against those of the other. (2) Members of both groups agree exactly in respect of sensitivity to heat (24 hours' exposure to a temperature of 50°). Koch's potato mottle virus [*R.A.M.*, xv, p. 459 *et passim*] may constitute a transitional phase between the two categories under discussion.

Köhler (E.). **Beobachtungen über Virusresistenz bei Kartoffelsorten.** [Observations on varietal resistance to viruses in Potatoes.]—*Züchter*, xx, 12, pp. 321–324, 1938.

On the basis of field observations in 1937 at Dahlem, Berlin, the author classified 26 potato varieties into four groups, the first comprising varieties susceptible to both leaf roll and virus Y [*R.A.M.*, xvi, p. 401], the second those susceptible to leaf roll while their reaction to virus Y is not clear, the third those susceptible to virus Y with an uncertain reaction to leaf roll, and the fourth those with reduced susceptibility (either active resistance or tolerance) to both viruses.

A more thorough trial of Altgold, Flava, Jubel, Parnassia (all group IV), Centifolia, Sickingen, Voran (all group I), and Stärkereiche (II) showed that none was resistant to leaf roll, although Altgold, Jubel, Flava, Voran, and Parnassia possessed a high degree of tolerance, being just as receptive to the virus as the strictly susceptible varieties but suffering little or no injury. Altgold and Jubel were highly intolerant and Parnassia moderately tolerant of virus Y. The yields of Altgold, Flava, Jubel, Voran, and Parnassia remained relatively stable for three successive years, whereas those of Centifolia, Sickingen, and Stärkereiche decreased considerably owing to infection. The yield of Voran, which showed severe symptoms of disease, compared surprisingly well with others, indicating a considerable tolerance of both viruses.

It is concluded that by means of transgressive breeding a much higher degree of resistance to, or even immunity from, virus Y could be achieved. It is believed also that a higher degree of tolerance of leaf roll can probably be obtained, and it is suggested that some of the varieties in group II may prove more resistant than the eight tested.

Dennis (R. W. G.). **Studies on Solanum virus 4.**—*Phytopathology*, xxix, 2, pp. 168–177, 1 fig., 1939.

Solanum virus 4 (= virus B) from an Up-to-Date potato plant was freed from contamination by *S.* virus 1 (= X) [*R.A.M.*, xv, p. 310] by passage through the X-resistant U.S.D.A. 41956 potato seedling at the Potato Virus Research Station, Cambridge, and its symptoms studied on 18 other hosts, of which *Datura stramonium* and tomato were found to be the most valuable for diagnostic purposes. The former host reacts by a bright systemic mottle with slight necrosis and deformity, and the latter by a characteristic yellow interveinal mosaic. It was found possible to infect King Edward and Arran Crest potatoes with *S.* virus 4 by sap inoculation, the virus being recovered unchanged from the former following infection by this method. In the case of other varieties sap inoculation results in the production of local lesions only.

S. virus 4 was inactivated by exposure to a temperature of 70° C., but withstood 65°; it resisted dilution in tobacco sap to 1:100,000 and survived in expressed juice for six weeks.

Mixed infections of *S.* virus 4 with *Nicotiana* virus 1 (= tobacco mosaic) and *S.* virus 2 (= Y), respectively, confirmed the affinity of the first-named with *S.* virus 1. Reinoculation experiments on tobacco, *D. stramonium*, and potato showed that the previous infection of a host with either *S.* virus 1 or *S.* virus 4 does not protect it against subsequent attack by the other.

It is concluded that the strain of *S.* virus 4 under investigation was in a pure state and solely responsible for the manifestations described.

Dennis (R. W. G.). **Notes on the photoperiodic reactions and virus contents of some Peruvian Potatoes.**—*Ann. appl. Biol.*, xxvi, 1, pp. 87–101, 2 pl., 1939.

A consignment of 59 potato varieties collected at Puño by the Percy Sladen Expedition to Lake Titicaca was received in 1937 at the Potato Virus Research Station in Cambridge, and during 1938 their photoperiodic reactions and virus contents were determined in an insect-

proof greenhouse. Among these varieties two forms of Papa surimana, with pink and purple tubers, respectively, appeared to belong to *Solanum chaucha*; Azul parcco, Parcco caramo, Parcco hancco, Luqui mari, and perhaps Pocco tturo huilla appeared to form a homogeneous group so far unidentified, and most of the other varieties are provisionally regarded as forms of *S. andigenum.*

Sap inoculation and graft experiments revealed the absence of viruses in 11 varieties; in the remaining 48 viruses X, B, C, F, G, and possibly leaf roll were detected, and in six varieties viruses or virus complexes were discovered which seemed to correspond to none of the known European viruses. In small-scale infection experiments certain of the Peruvian potatoes were found to contract leaf roll, interveinal mottle (mild X), top necrosis (X+C), and leaf-drop streak [*R.A.M.*, xviii, p. 197], suggesting that great caution should be exercised in introducing South American varieties into England.

Botjes (J. O.). **Een zwakke stam van het virus van de grofmozaïekziekte.** [A weak strain of the mild mosaic disease virus.]—*Tijdschr. PlZiekt.*, xlv, 1, pp. 25–29, 1939. [English summary.]

In addition to the normal dark green-leaved Industrie potatoes under cultivation in Holland, a variant with pale green foliage has developed under the influence of a virus which was shown to be a weak strain of mild mosaic [*R.A.M.*, xviii, p. 337] and is named mild mosaic *b* to distinguish it from the ordinary strain *a*. The former was found to occur in the Juli variety as well as in the pale Industrie, and to be transmissible from both to Eigenheimer and Alpha. Mild mosaic *b* confers a high degree of immunity from mild mosaic proper but not from leaf roll.

Lepik (E.). **Meie Kartulisortide lehemädanikukindlusest.** [Varietal resistance of Potatoes to late blight.]—*Agronoomia*, xviii, 9, pp. 686–692, 741, 4 graphs, 1938. [English summary.]

In 1934 and 1937, when severe epidemics of late blight (*Phytophthora infestans*) occurred in the Estonian potato crop [*R.A.M.*, xvii, p. 482], a high degree of resistance was shown by Hellena, Jõgeva 979, and Alpha and marked susceptibility by Duke of York, Väike verev, Early Rose, Early Puritan, Victoria, Epicure, May Queen, and Charles Downing. Included in the resistant group were Hero, Jubel, Imperator, Industrie, Belladonna, Lorch, Deodara, Pepo, Parnassia, Edeltraut, Kungla, Silesia, and Jõgeva 30; in the medium-resistant Majestic and Centifolia; and in the susceptible Odenwälder Blaue and Royal Kidney.

Lunden (A. P.). **Mål og metoder ved foredlingsarbeidet for sykdomsresistens hos Poteten (Solanum tuberosum).** [Objects and methods in the work of breeding Potatoes (*Solanum tuberosum*) for resistance to disease.]—*Meld. Norg. LandbrHøisk.*, xviii, 3, pp. 183–198, 1938.

In Norway, as elsewhere, late blight (*Phytophthora infestans*) is the most destructive and economically important disease of potatoes [*R.A.M.*, xi, pp. 669, 670]. In the severe epidemic of 1927 the yield amounted to only 605,000 tons compared with averages of 823,000 and 921,000 for the five-year periods 1926 to 1930 and 1931 to 1935,

respectively. It is estimated that in the same year the production of the three most resistant varieties, Marius, Jubel, and Centifolia, was double that of the three most susceptible, Up-to-Date, Great Scot, and Tinwald Perfection. In three years' spraying experiments on a highly susceptible variety there was an average increase of 30 per cent. in the yield of sound tubers and of 40 per cent. in that of dry weight.

Next to late blight, blackleg (*Bacillus carotovorus*) [*Erwinia phytophthora*: ibid., viii, pp. 195, 397] is the most serious disease of the Norwegian potato crop, which on the other hand is stated to sustain relatively little damage from viruses on account of the scarcity of aphids in the cool climate. Wart (*Synchytrium endobioticum*) [ibid., xiv, p. 252] is no longer an economic factor now that immune varieties of superior quality and flavour are available. The various types of scab associated with *Actinomyces* spp. [chiefly *A. scabies*], *Spongospora subterranea*, *Corticum vagum* [*C. solani*], and *Spondylocladium atrovirens* [ibid., xvii, p. 835] are mainly injurious to culinary potatoes. Minor disorders of sporadic occurrence include *Verticillium* and *Fusarium* spp., *Phoma eupyrena* [Wollenweber, *Arb. Forsch Inst. Kartoff., Berl.*, ii, 73, 1920], *Oospora pustulans* [ibid., xiv, p. 466], and *Bacterium sepedonicum*.

Some outstanding researches in connexion with breeding potatoes for resistance to various diseases are summarized.

LEACH (J. G.), DECKER (P.), & BECKER (HANNAH). **Pathogenic races of Actinomyces scabies in relation to scab resistance.**—*Phytopathology*, xxix, 2, pp. 204–209, 4 figs., 1939.

In a limited number of greenhouse soil inoculation tests at the Minnesota Agricultural Experiment Station in 1936–7 and 1937–8, potato seedling 5–10–1 proved to be very susceptible to a strain of *Actinomyces scabies* designated race 1 and highly resistant to another strain (race 2), while Jubel was also highly resistant to race 2 but only moderately susceptible to 1. Warba, U.S.D.A. seedling 44537, and Arnica (the two latter tested in 1936–7 only) are highly, moderately, and slightly susceptible, respectively, to both isolates, which were derived from a severe pitted type of infection on the 5–10–1 and Irish Cobbler varieties. These results are considered to afford conclusive proof of the existence of physiologic specialization in *A. scabies*, and furthermore to explain the observed discrepancies in varietal reaction to the disease in different localities. The relatively small number of lesions developing on 5–10–1 is believed to be attributable to the morphological resistance to invasion offered by the small, compact lenticels of this variety [*R.A.M.*, xvi, p. 556], but physiological factors are also thought to be involved in the differential response of various potato types to the disease.

The occurrence in the United States of the tuber ring rot and wilt of the Potato.—*Plant Dis. Reptr*, xxii, 22, pp. 444–445, 1938. [Mimeographed.]

Potato tuber ring rot and wilt (*Bacterium sepedonicum*) [*R.A.M.*, xviii, p. 53) is now known to occur in Maine, Florida, Pennsylvania, Wyoming, and Colorado. In a note on p. 446 by G. H. Starr, evidence is briefly presented for the transmission of the disease through seed

planted on virgin soil by the tuber unit method, which gave rise to an average of 10 per cent. infection.

OKADA (Y.). **On the distribution of Trichoderma in the soils of various types of vegetation on Mt. Hakkoda.**—*Sci. Rep. Tôhoku Univ.*, Ser. 4, xiii, 3, pp. 271–279, 1938.

A tabulated account is given of the writer's studies on the distribution of *Trichoderma koningi* [*R.A.M.*, xvii, pp. 624, 838] in relation to the various types of plant community on Mount Hakkoda, Japan [cf. ibid., xvii, p. 484]. The presence of the fungus was demonstrated by the method of directly streaking from the freshly exposed soil surface on a plate of Waksman's peptone-glucose acid agar [ibid., ii, p. 233]. *T. koningi* was found to occur in eight of the nine soils of different ecological associations studied, viz., Pseudosasetum (P_H 4·7), Fagetum (3·7), Abietetum (3·7), Pinetum (3·7), detritus surrounding the crater of the volcano (5·4), Cladonietum (2·8 to 3·1), *Sphagnum* moor (3·7), and Narthecietum (3·7), being absent only from bare land near the solfatara (2 to 2·2). The incidence of the mould was high in soils rich in raw humus, and low in waterlogged ground. In the Pseudosasetum soils *T. koningi* was found (mostly in spore form) at a depth of 40 but not at 70 cm.

KOVACHEVSKY [KOVAČEVSKI] (I. C.). Нови паразитни гжби за България. V приносъ. [Parasitic fungi new for Bulgaria. Fifth contribution.]—*Rev. Inst. Rech. agron. Bulg.*, viii, 4, pp. 3–13, 1938. [English summary.]

In this contribution [cf. *R.A.M.*, xvi, p. 493] the following species are recorded in Bulgaria for the first time: *Bacterium panici* [ibid., xvii, p. 810] on millet (*Panicum miliaceum*), *Bact. woodsii* on carnation [ibid., xvii, p. 728], *Bact. glycineum* on soy-bean [ibid., xvi, p. 585], *Puccinia antirrhini* on snapdragon (*Antirrhinum majus*) [ibid., xviii, pp. 11, 128], *Didymella lycopersici* on tomato [ibid., xvii, p. 15], *Ascochyta abelmoschi* on okra (*Hibiscus esculentus*) [ibid., vii, p. 297], *Diplodina citrullina* on stems and young fruits of sugar melon, *Septoria acicola* on *Pinus austriaca* [ibid., xvi, p. 218], *S. carthami* on safflower [ibid., xiv, p. 493], *S. pisi* (probably identical with *Rhabdospora hortensis*) on pea [ibid., xviii, p. 237], *Gloeosporium musarum* on banana [ibid., xviii, p. 124], *Ramularia pastinacae* on parsnip [ibid., vii, p. 701], *Cladosporium fulvum* on tomato [ibid., xviii, p. 280], *C. aecidiicola* on spots caused by *Gymnosporangium sabinae* on pear [ibid., xvii, pp. 20, 288], *Cercospora carotae* on carrots [ibid., xvii, p. 17], *C. concors* on potato [ibid., xv, p. 246], and *Fusarium bulbigenum* on *Narcissus* [ibid., xv, p. 224]. A list of new Bulgarian hosts for 12 known parasitic fungi is appended.

KRUSZYŃSKI (R.). **Krytyczny przegląd chorób roślin zaobserwowanych w północno-wschodniej Polsce w latach 1928–1937 ze szczególnym uwzględnieniem ich znaczenia gospodarczego.** [Critical survey of plant diseases recorded from 1928 to 1937 in north-east Poland, with particular reference to their economic importance.]—*Roczn. Ochr. Rośl.*, v, 6, pp. 68–110, 1938. [German summary.]

This is an annotated list of 257 diseases of economic and ornamental crops, recorded in north-east Poland from 1928 to 1937, inclusive.

Černik (L. F.). **Krankheiten und teratologische Missbildungen (auch typische Verletzungen), an Pflanzen der Olmützer Flora. X Teil.** [Diseases and teratological malformations (also typical injuries) on plants of the Olmütz flora. Part X.]—*Verh. naturf. Ver. Brünn, 1937*, lxix, pp. 91–122, 13 figs., 1938.

This is an annotated list of plant diseases in the Olmütz district of Czechoslovakia [cf. *R.A.M.*, xvii, p. 704].

Bisby (G. R.), Buller (A. H. R.), Dearness (J.), Fraser (W. P.), & Russell (R. C.). **The fungi of Manitoba and Saskatchewan.**—189 pp., 13 pl., 1 map, Nat. Res. Counc. Can., 1938 [issued February, 1939]. $3.50.

This expanded version (to which a preface is contributed by H. T. Güssow) of 'The Fungi of Manitoba' [*R.A.M.*, xi, p. 546] brings the total number of species studied in the two provinces of Manitoba and Saskatchewan to 2,782. The work comprises an introductory analysis of the fungus flora considered under various aspects, taxonomic and geographical notes on most of the species recorded, among which are many parasites of cereals and other cultivated plants, host and fungus indexes, and a nine-page bibliography.

Wehmeyer (L. E.). **Las especies de 'Diaporthe' en el herbario Spegazzini.** [The species of *Diaporthe* in the Spegazzini herbarium.]—*Rev. Mus. La Plata*, N.S., ii, pp. 65–68, 3 pl., 1938.

This annotated list of the species of *Diaporthe* [*R.A.M.*, xiii, p. 270] in Spegazzini's herbarium comprises, *inter alia*, an emendation of Petrak's genus *Cryptodiaporthe* with two new combinations, and a new genus *Melanoporthe* [with a Latin diagnosis], differentiated from the typical representatives of the 'effuse' group by the black coloration of the spores at maturity.

Ray (W. W.). **Contribution to knowledge of the genus Taphrina in North America.**—*Mycologia*, xxxi, 1, pp. 56–75, 23 figs., 1939.

Observations [with Latin diagnoses of new species] are presented on some North American species of *Taphrina* found on *Alnus* and *Prunus* spp., the author following Giesenhagen in including in *Taphrina* all those species formerly included in *Exoascus*, *Taphrina*, and *Magnusiella* [*R.A.M.*, xvii, p. 841]. On *Alnus* are recorded *T. robinsoniana* [ibid., xviii, p. 281], *T. rugosa* n.sp., *T. occidentalis* n.sp. (all on catkins), and *T. media* (on leaves: a new record for North America), and on *Prunus* *T. atkinsonii* n.sp. (fruits and flower parts), *T. farlowii* (fruits), *T. confusa* (flowers), *T. communis* (shoots and fruits), and *T. flavorubra* (shoots and fruits).

The evidence obtained indicated that *T. robinsoniana* causes the catkin disease of *A. incana* and *A. rugosa* in the United States during the summer. Search among different collections failed to show that *T. amentorum* causes any catkin disease of *A. incana* in the United States, though it was observed on the bracts of female catkins of *A. oregona* in a collection made in Alaska in 1899. This fungus was

named *E. amentorum* by Sadebeck in 1888, while in 1890 Magnus named it *T. alni-incanae* [ibid., xv, p. 693], the name now generally used.

RISCHKOV [RYJKOFF] (V. L.) & SOUKHOFF (K. S.). **Virus of Tobacco mosaic tested for its power of fermentative activity.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xxi, 5, pp. 265–268, 1938.

Brief details are given of experiments, the results of which showed that the crystalline protein virus of common tobacco mosaic, prepared by Ryjkoff and Gromyko's method [*R.A.M.*, xvii, p. 708] does not exhibit *in vitro* the properties of an oxidase, peroxidase, catalase, protease, asparaginase, urease, amylase, chlorophyllase, or phosphatase, neither did it show any activating effect on peroxidase. The authors conclude that the increased activity of peroxidase, amylase, and proteases in mosaic-affected plants is due to the effect of the virus on the host rather than to its direct action on these substances. In their opinion the virus, unlike other parasites, does not possess enzyme systems of its own, and is unable to assimilate the proteins of the host.

BAWDEN (F. C.) & SHEFFIELD (F[RANCES] M. L.). **The intracellular inclusions of some plant virus diseases.**—*Ann. appl. Biol.*, xxvi, 1, pp. 102–115, 2 pl., 1939.

In this study on the inclusion bodies in virus-infected plant cells [*R.A.M.*, xviii, p. 62] the authors found both amorphous bodies and crystalline plates in cells of plants infected with the common, enation, and aucuba types of tobacco mosaic. The amorphous (or X-) bodies of all three strains are relatively stable, are preserved by ordinary cytological fixatives, and give the usual protein reactions; those of common tobacco mosaic and enation mosaic are small, resemble amoebae, measure about 10 μ in length, contain vacuoles, chondriosomes, and oil globules, and frequently change their shape, while those of aucuba mosaic are somewhat larger than the other two, more granular, and less like the surrounding cytoplasm. The actual formation of these bodies has been observed in detail only in the case of aucuba mosaic [ibid., ix, p. 538; xiv, p. 51]. After some time the amorphous bodies degenerate and their place is taken by crystalline plates which are formed either separately or in the same cells as the amorphous bodies. They are best seen in living material, since fixation destroys them or causes the formation of numerous striations, an effect responsible for the term 'striate material' for these bodies. They give protein reactions, are very fragile, colourless and transparent, have a refractive index higher than the cell sap, and are true crystals. Under good growing conditions the amorphous bodies are formed about a week after infection, rapidly increasing in number and reaching a maximum about a month after infection; after another month they either disappear, as in tobacco mosaic, or disintegrate and form crystals, as in aucuba mosaic, which disappear in turn after a few months.

It is considered highly improbable that the crystalline inclusions are deposits of pure virus; they are more likely to be insoluble complexes formed by the union of the virus with some constituents of the host. It is shown that the purified virus readily united *in vitro* with some protamines and histones (clupein was specially studied) to form

insoluble complexes, which in many ways resemble the crystalline inclusions. As to the amorphous inclusion bodies, their amorphous nature, greater stability, and different solubility seem to indicate that the virus is combined with a constituent of the host different from that suggested for the crystalline plates, and that the ratio of this constituent to virus is greater than in the crystalline plates. If the inclusions are complexes of the type suggested above, their formation is determined not by the virus concentration [cf. ibid., xvi, p. 570] but by the presence in diseased plants of products not found in healthy cells, capable of uniting with the virus to form the insoluble complexes.

In work with other viruses potato virus Y and cucumber viruses 1, 3, and 4 failed to produce inclusions of any kind; tobacco ring spot virus produced both amorphous and crystalline inclusions in tobacco and other Solanaceous plants, but only few amorphous bodies in cucumber; potato virus X and *Hyoscyamus* virus 3 produced only amorphous bodies; and tomato bushy stunt virus formed no inclusions in the majority of plants, but in a few amorphous bodies were present, and all contained much crystalline material.

PIRIE (N. W.), SMITH (K. M.), SPOONER (E. T. C.), & MCCLEMENT (W. D.). **Purified preparations of Tobacco necrosis virus (Nicotiana virus II).**—*Parasitology,* xxx, 4, pp. 543–551, 1 pl., 1 graph, 1938.

From the sap expressed from White Burley tobacco leaves artificially infected with tobacco necrosis [*R.A.M.*, xviii, p. 348] (800 to 1,000 plants being necessary to produce 2 l. sap with a virus content of 0·04 per cent.), the authors obtained, by a process involving precipitation with saturated ammonium sulphate solution and repeated centrifuging, one nucleoprotein in a crystalline state with a sedimentation constant of 130×10^{-13} and another in an amorphous state, its principal component having a sedimentation constant of 58×10^{-13}. The former separates as thin, lozenge-shaped plates, which are birefringent. Both preparations had substantially the same analytical composition and, like the tomato bushy stunt virus [ibid., xviii, p. 353], show no anisotropy of flow in solution, while the jelly that sediments on centrifugation is also isotropic; the phosphorus and carbohydrate contents were higher than those of the other plant viruses that have been studied. The greater part of a fresh preparation is amorphous, but on ageing gives rise to more crystalline material. Attempts to accelerate the ageing process, however, were unsuccessful and the nature of the difference between the two states remains obscure. Injections of the purified tobacco necrosis virus given intravenously to rabbits resulted in antibody formation, demonstrated by flocculation reactions. Sera which flocculated the purified tobacco necrosis antigens gave no cross-reactions with purified bushy stunt and tobacco mosaic antigens, nor with preparations of healthy sap, indicating that the antigen concerned is intimately associated with the tobacco necrosis virus if it is not the virus itself. Tested on *Phaseolus vulgaris,* which proved to be more sensitive to the virus than tobacco, both preparations were infective at a dilution of 1 in 10^8, and precipitated specifically with anti-serum at a dilution of 1 in $3{\cdot}2\times10^5$.

Clayton (E. E.), Gaines (J. G.), Smith (T. E.), Lunn (W. M.), & Shaw (K. J). **Control of the blue mold (downy mildew) disease of Tobacco by spraying.**—*Tech. Bull. U.S. Dep. Agric.* 650, 23 pp., 5 figs., 1938.

During the epidemic outbreak of tobacco downy mildew (*Peronospora tabacina*) [*R.A.M.*, xviii, p. 350 and next abstracts] in the United States in 1937, encouraging results in spraying tests in different localities were given by a mixture consisting of red copper oxide ($\frac{1}{2}$ to $\frac{3}{4}$ lb.), lethane spreader (1 qt.), and cottonseed oil ($\frac{1}{2}$ gal.), with water added to make 50 gals. The beds were sprayed twice weekly, five or six applications generally being made before the outbreak became general, and the spraying was continued until the plants were set out or the disease became inactive. The maximum number of applications required was about 15, but that actually given was 23. The treatment generally delayed the appearance of the disease, greatly retarded its development, and considerably reduced its severity. In no sprayed bed did plant mortality from the disease exceed 16 per cent., while in the unsprayed beds it ranged up to 94 per cent. In only two sprayed beds were more than 5 per cent. of the plants killed, while in most of the unsprayed controls 20 to 50 per cent. of the plants were destroyed. In the sprayed beds active disease development in no case persisted for more than four days, after which recovery was prompt and complete, while in the controls infection was active for periods of up to three weeks, and transplanting was delayed for ten days to five weeks. Field stands from the sprayed beds were uniformly good, even if the plants were set out when the disease was most active. On an average, each 100 sq. yds. of sprayed bed gave $2\frac{1}{2}$ to $3\frac{1}{2}$ acres of tobacco, as against 0 to $1\frac{1}{3}$ acres from the same area of unsprayed. Colloidal copper, copper-soap, and calcium monosulphide were all superior to Bordeaux mixture but none was effective enough to be recommended.

Pinckard (J. A.), Wolf (F. A.), McLean (Ruth), Darkis (F. R.), & Gross (P. M.). **Laboratory studies on toxicity of benzol vapors to Tobacco seedlings and to Peronospora tabacina.**—*Phytopathology*, xxix, 2, pp. 177–187, 2 figs., 1 diag., 1939.

An account is given of laboratory experiments to determine the minimal concentrations of benzol vapour in air toxic, respectively, to tobacco seedlings and *Peronospora tabacina*, the agent of downy mildew [see preceding and next abstracts]. The tests were carried out in (*a*) bell jars sealed with various materials, of which shellac was the best, and (*b*) a specially devised apparatus consisting of open chambers fitted with a circulation pump for the continuous renewal of the benzol-air mixture. The volume-percentage concentrations of benzol in the benzol-air mixtures were analysed by the combustion method and found to agree very closely with the calculated values.

At atmospheric pressure, concentrations of benzol vapour in air exceeding about 2 per cent. by volume were injurious to the seedlings if the foliage was wet during the treatment, the corresponding strength for dry leaves being 3 per cent. The sporangia of the fungus were destroyed by concentrations of benzol vapour in air of 0·5 per cent.

and upwards, but the repeated exposure of infected seedlings to less than 0·5 per cent. of benzol by volume inhibited sporulation. At pressures less than atmospheric, injury was caused by lower concentrations of the vapour.

The mechanism of the toxic action of benzol towards plants would appear from these studies to involve, in the first place, absorption by the cell walls, and secondly, the dissolution of the lipoidal substances in the plasma membrane, leading to adverse modifications of permeability and allied functions.

Wolf (F. A.), Pinckard (J. A.), Darkis (F. R.), McLean (Ruth), & Gross (P. M.). **Field studies on concentration of benzol vapours as used to control downy mildew of Tobacco.**—*Phytopathology*, xxix, 2, pp. 103–120, 2 figs., 1 diag., 4 graphs, 1939.

Previous field and laboratory experiments demonstrating the efficacy of benzol vapours in the control of tobacco downy mildew [*Peronospora tabacina*: see preceding and next abstracts] were confirmed by the present series of seed-bed trials on some 25 standard flue-cured varieties, Turkish, Burley, and hybrids in North Carolina and Virginia.

The use of a Mine Safety Appliance combustible gas indicator [ibid., xviii, p. 63] facilitated the computation of measurements of the benzol vapour concentration. The limits of toxicity of the fumigant to the pathogen (0·40 to 0·50 per cent. by volume) and to the host (2 to 2·5 per cent.) are so widely separated that the risk of injury to the seedlings, even from a heavy excess dose, is regarded as negligible. Factors influencing the efficiency of benzol fumigation, as measured by vapour concentrations, include the amount applied per unit area of seed-bed; ratio between area of evaporators and that of seed-bed; porosity and penetrability of the covers conditioned by their texture and by the amount of rain or dew collecting on them; modifications in the volatilization rate induced by temperature and the mixture of lubricating oil with the benzol; and the presence of water on the foliage of the seedlings. Of these, the most important is the presence of moisture on the covers and on the plants, bearing out laboratory observations on the mechanism of the action of benzol vapour through the vehicle of water [loc. cit.]. The effective concentrations of the vapour in the free water on the foliage and in the cell constituents have not yet been exactly defined, but are assumed from the available evidence to be in excess of those in the atmosphere of the beds.

Wolf (F. A.). **Status of investigations of Tobacco downy mildew.**—*Phytopathology*, xxix, 2, pp. 194–200, 1939.

Summing up the present position as regards the knowledge of the endemism of tobacco downy mildew (*Peronospora tabacina*) [see preceding and next abstracts] in the United States, the sources of inoculum, dissemination of sporangia, and climatic factors in relation to the disease, the writer draws attention to the lack of information concerning the vital phenomena of oospore production and the potential acquisition of immunity by seedlings recovering from an attack. Various fundamental problems connected with the control of the mildew by benzol also remain to be solved.

Pinckard (J. A.) & McLean (Ruth). **Paradichlorbenzol, an eradicant fungicide, effective against downy mildew of Tobacco.**—*Phytopathology*, xxix, 2, pp. 216–219, 3 figs., 1939.

In tobacco seed-bed experiments during the downy mildew [*Peronospora tabacina*: see preceding abstracts] epidemic of 1938 in North and South Carolina and Virginia, repeated nightly applications at a maximum temperature below 75°F. of 28 gm. crystalline paradichlorbenzol were found to be fungistatically equivalent to 25 ml. liquid benzol in seed-beds 4 sq. yds in area, covered with cotton sheeting of a warp and woof of 64 threads per in. and a weight of 1 lb. per 2·68 sq. yd. It was essential, however, to place the crystals above the plants on netting evaporators protected against the weather; muslin sheeting, as ordinarily used on seed-beds, proved ineffectual in the retention of the heavy vapours preventing infection. Eradicant fungicidal vapour concentrations were obtained in seed-beds 4 sq. yds in area by one 12-hour treatment with 112 gm. crystalline paradichlorbenzol spread over net evaporators 18 in. square. An increase in the concentration of the fumigant by the use of 225 gm. resulted in an approach to phytocidal strength, while a 453 gm. dose was definitely injurious to the plants.

Thung (T. H.). **De epidemiologie van de Phytophthora parasitica var. nicotianae op de Vorstenlandsche Tabaksondernemingen.** [The epidemiology of *Phytophthora parasitica* var. *nicotianae* on the Vorstenland Tobacco plantations.]—*Meded. Proefst. vorstenl. Tab.*, 86, 55 pp., 1 fig., 1 diag., 1 graph, 1938. [English summary.]

In laboratory inoculation tests at the Vorstenland (Java) Tobacco Experiment Station, *Phytophthora parasitica* var. *nicotianae* [*R.A.M.*, xvii, p. 490] was found to be capable of attacking, besides tobacco, wounded leaves of cassava, *Eriodendron anfractuosum*, papaw, *Jatropha curcas*, *Ricinus communis*, and eggplant, corresponding uninjured material being infected only in the cases of *J. curcas* (1 out of 5) and *R. communis* (5 out of 5). The fungus was further shown to thrive in samples of the silt, sand, clay, and loam soils constituting singly or in combination the tobacco-growing land of the district.

The zoospores of *P. parasitica* var. *nicotianae* are frequently liberated immediately the sporangia come into contact with water, but in some of the writer's tests a fall of temperature from the initial 27° to 28·5° C. was requisite to induce the process (e.g., five minutes at 16° or 19° or ten at 17·5°). The zoospores were unable to infect the upper side of tobacco leaves in inoculation experiments and attacked the under side only with difficulty, but readily formed new mycelium in the above-mentioned soils and on oatmeal or plum agar. The fungus was killed by one hour's exposure to a temperature of 50° and by two hours at one of 49°, as well as by desiccation (one month over lime in culture tubes, nine in soil in the laboratory). Soil temperature data indicated that, in general, the hot, dry tobacco-growing areas of the Vorstenland are free from infection before planting, exceptions being sites surrounding barns, old rice seedling beds, and water inlets, where diseased plants constituted an average of 21·6 per cent. of the total in 1936. In constantly shaded moist soils *P. parasitica* var. *nicotianae* may persist

throughout the year; in the water of rice fields and streams the temperature mostly permits survival, but the fungus is liable to bacterial and protozoan attacks. Rain brings about a fall in soil temperature that assists the liberation of the zoospores, which are transported by water and convey infection to new areas, especially in low-lying situations. Four years' observations on the incidence of soil and water infections on a heavily infested site denoted that an epidemic increase of inoculum takes place solely on the tobacco plants, the first diseased individuals serving to spread contagion over the entire plantation and its surroundings unless instantly checked. Manure introduced into the plantations from villages still appears to be a prolific source of contamination. The infestation of stream and irrigation channel water is a factor of importance only when the tobacco crop is actually under cultivation.

Particulars are given of a new method for the detection of *P. parasitica* var. *nicotianae* in soil and manure, applied as follows. Water flowing at a velocity of 20 l. in 15 minutes carries infection from a suspension of soil or manure over a series of three tins, each containing 16 tobacco leaves, for two hours, after which the leaves are transferred to other tins and kept moist for three days; at the end of this period the incidence of infection may be gauged by the number of spots formed.

Paul (W. R. C.) & Fernando (M.). **Some studies on Tobacco diseases in Ceylon. V. The use of fungicides in the control of damping-off of Tobacco seedlings.**—*Trop. Agriculturist*, xci, 6, pp. 338–344, 2 pl., 1 graph, 1938.

The authors present some data collected during an experiment in 1938 at the Ganewatta Experiment Station, showing that damping-off (*Pythium* spp.) of tobacco seedlings in the seed-bed was almost completely controlled by weekly spraying with a proprietary colloidal copper compound (1 oz. per gal. plus $\frac{1}{16}$ oz. proprietary spreader), whereas a proprietary product containing 25 per cent. salicylanilide and a proprietary copper-lime dust gave no significant control. The total cost of treatment with the first-named fungicide was estimated to be under 20 cents for an area of seed-bed sufficient for planting one acre in the field.

Milbrath (J. A.). **Tomato tip-blight virus.**—*Phytopathology*, xxix, 2, pp. 156–168, 4 figs., 1939.

In further studies on the tomato tip blight virus at the Oregon Agricultural Experiment Station [*R.A.M.*, xviii, p. 350], the writer found that undiluted juice loses its infectivity within an hour at 65° F. or above. The thermal death point is very low, lying between 40° and 41·5° C., or close to 36° for juice heated in 250 c.c. flasks. Inoculation experiments on Connecticut Havana tobacco leaves showed that dilution with water causes a rapid loss of virulence, the average number of local lesions per leaf being reduced from 17·2 for undiluted juice to 12·4, 5·6, and 0 for dilutions of 1 to 1, 1 to 20, and 1 to 50, respectively.

Tomato, *Datura stramonium*, *Solanum capsicastrum*, Bliss Triumph potato, nasturtium (*Tropaeolum*) [*majus*], and tobacco were found to be the most suitable hosts for the symptomatological differentiation of the virus. The outstanding features of infection, either natural (by

Thrips tabaci) or artificial, on tomato are stem-streaking and circular, necrotic, foliar lesions. Local necrotic lesions may or may not develop on *D. stramonium* leaves; if present they are few, of irregular outline, and black. The secondary lesions formed on the younger foliage are at first faintly chlorotic, circular, with a small, necrotic centre which eventually spreads until the whole spot becomes a black lesion coalescing with the adjoining ones. Finally, severance takes place at the abscission layer and the leaf falls from the plant. On *S. capsicastrum* the only symptoms are large, black, necrotic local lesions with a faint chlorotic edge, usually only one or two per leaf. The black, necrotic lesions formed five to six days after inoculation on potato leaves attain a diameter of nearly ½ in. and assume a concentric configuration due to the presence of slightly raised, dark, narrow ridges. The remaining area soon becomes chlorotic and the leaf falls from the plant. Infected nasturtium leaves turn yellow or orange, and eventually wither and die. The secondary symptoms are a striking patchy or diffuse mottling or the formation of circular, black spots with pale green margins. Although the affected leaves soon wither and drop, the meristematic regions are not destroyed and new foliage continues to develop. Black, necrotic local lesions are produced on tobacco leaves four or five days after inoculation, and are occasionally followed by secondary necrotic spotting.

Attention is drawn to some important differences between the tomato tip blight virus and the following tomato diseases with which it might be confused: *Datura* virus 1 [bushy stunt: ibid., xviii, pp. 210, 353], ring spot type of tomato virus [ibid., xvi, p. 501], die-back streak [ibid., xiv, p. 201], and spotted wilt [ibid., xviii, p. 65]. Die-back streak is thought to be possibly due to a mixture of the spotted wilt and tip blight viruses.

Harrison (A. L.), Young (P. A.), & Altstatt (G. E.). **Control of Tomato diseases in the seed bed and cold frame.**—*Circ. Tex. agric. Exp. Sta.* 82, 14 pp., 4 figs., 1939.

Directions are given in popular terms for the control of the following diseases affecting tomatoes in the seed-bed and cold frame in Texas: pre- and post-emergence damping-off (*Pythium*, *Phytophthora*, and *Rhizoctonia* spp.), collar rot (*Rhizoctonia* and *Alternaria* [*solani*: *R.A.M.* xviii, p. 66]), mosaic, bacterial spot [*Bacterium vesicatorium*: ibid., xvi, p. 419], bacterial canker [*Aplanobacter michiganense*], stem canker (*Alternaria solani*), leaf spot [*Septoria lycopersici*], and early blight [*A. solani*]. Seed treatment with cuprocide, metrox (purple copper oxide) [ibid., xvi, p. 625] (both at ⅔ oz. per lb.), 2 per cent. ceresan (⅕ oz.), or semesan ($\frac{1}{11}$ oz.) is recommended against pre-emergence damping-off, while the later phase of the same trouble may be arrested by drenching the surface of the soil with semesan 1 in 400, 1½ qts. per 10 sq. ft., cuprocide or cuprocide-54 [ibid., xvii, p. 722] (1 and 1¾ lb. in 50 gals. water, respectively). Collar rot may be combated by thorough applications of Bordeaux mixture 3–3–50 or cuprocide-54 (1¾–50), the former at 10- to 14-day intervals also being effective against leaf spot and blight.

Artemieva (Mme Z. S.). Исследования штаммов возбудителя бактериального рака Томатов. [A study of the strains of the causal organism of Tomato bacterial canker.]—*Pl. Prot., Leningr., 1938*, 17, pp. 137–140, 1938.

The author states that while so far *Aplanobacter michiganense* has not been recorded officially on tomatoes in the U.S.S.R. [*R.A.M.*, xv, p. 399], isolations from dried specimens of tomato plant parts and fruits received from the Crimea and North Caucasus yielded numerous strains of bacteria, certain of which closely resembled in their morphological, cultural, and biochemical properties the description of *A. michiganense*.

Park (M.) & Fernando (M.). **The relative resistance of some Tomato varieties to bacterial wilt (Bacterium solanacearum E.F.S.).**—*Trop. Agriculturist*, xci, 6, pp. 333–337, 1 diag., 1938.

The results of preliminary experiments in 1938 at Peradeniya, Ceylon, on soil heavily and comparatively uniformly infected with *Bacterium solanacearum* [*R.A.M.*, xvii, p. 631], showed that the eight tomato varieties tested ranged themselves in the following order of wilt resistance: Marvana, Red Marhio 2, Marglobe, Pritchard, Red Marhio 1, Break O'Day 1 and 2, and a local unnamed variety, the first three being significantly more resistant than the other varieties though no statistically significant difference was observed between the first three or the last five. The mortality, even in Marvana, was just under 50 per cent. and the infection in the remaining five varieties was in the neighbourhood of 66 per cent.

Strong (M. C.). **A new Fusarium-wilt-resistant Tomato.**—*Quart. Bull. Mich. agric. Exp. Sta.*, xxi, 3, pp. 164–169, 2 figs., 1 graph, 1939.

A strain of the John Baer tomato variety resistant to *Fusarium* [*bulbigenum* var.] *lycopersici* [*R.A.M.*, xvii, p. 419] has been developed at the Michigan State College. During a period of four years it has shown only from 7 to 19 per cent. infection in soils heavily infected with many different isolates of the fungus from a large number of localities.

Murrill (W. A.). **New Florida Polypores.**—*Bull. Torrey bot. Cl.*, lxv, 9, pp. 647–661, 5 figs., 1938.

An annotated list is given of 28 Polyporaceae, including 21 new species [with Latin diagnoses] and one new combination, collected in central Florida, mostly on decayed hardwood logs.

Jenkins (A[nna] E.) & Siegler (E. A.). **Distribution of popcorn disease of Mulberry.**—*Plant Dis. Reptr*, xxii, 21, pp. 435–438, 1 map, 1938. [Mimeographed.]

Since the distribution of the 'popcorn' disease of mulberry (*Sclerotinia carunculoides*) was defined in 1923 [*R.A.M.*, iii, p. 48], three new States have been added to the range of the fungus [data on which are tabulated], namely, Florida, Louisiana, and North Carolina. The disease was originally reported only on the introduced white mulberry (*Morus alba*), but a few records of its occurrence on the native red species (*M. rubra*) have since been received. Infected fruit is useless as fodder for hogs.

Pirone (P. P.). **The detrimental effect of Walnut to Rhododendrons and other ornamentals.**—*Plant Dis. Reptr*, xxii, 22, pp. 450–452, 1938. [Mimeographed.]

Attention is drawn to the toxic effects of black walnut (*Juglans nigra*) roots to *Rhododendron catawbiense* and other ornamentals in a New Jersey nursery. The nine-year-old rhododendrons were transplanted in the spring of 1938 to a cleared area on the slope of a hill, with five walnuts, 12 to 18 in. in diameter, left near the edge. Early in July the plants in a circular area below the largest tree suddenly wilted and died, and subsequently the bulk of the plot became similarly affected. The injury occurred mostly along the direction of the main walnut roots, spreading in fan-like areas away from the trunk. All attempts at the isolation of a pathogen from the diseased tissues gave negative results, and the removal of most of the walnut roots from the beds led to the rapid disappearance of the trouble. Evidently the roots secrete a substance (possibly juglone, according to A. B. Massey in *Phytopathology*, xv, pp. 773–784, 1925), which is antagonistic to other plants in the immediate vicinity but does not survive the eradication of the trees.

Miller (P. W.). **A promising new copper spray for the control of Walnut blight.**—*Proc. Ore. St. hort. Soc.* (*1938*), xxx, pp. 148–151, 1939.

The author states that in 1935 two applications of copper oxalate spray (1–50) applied to walnut trees in Oregon in the late pre- and early post-bloom stages reduced the incidence of blight (*Phytomonas* [*Bacterium*] *juglandis*) [*R.A.M.*, xvii, p. 420] from 58·6 (in the unsprayed controls) to 4·3 per cent., the corresponding figures for two applications of Bordeaux mixture (2–2–50) being 58·6 and 7·6 per cent. The treatment caused no perceptible foliage injury. In 1937, when infection was very severe, three applications of copper oxalate (2–50) made in the early pre-, late pre-, and early post-bloom stages reduced infection from 82·4 to 5·5 per cent., whilst similar applications of Bordeaux mixture (2–1–50) reduced it to 15 per cent. Used at half-strength, the copper oxalate was about equal to the Bordeaux mixture. In 1938, in the few districts where the disease was prevalent, copper oxalate again gave excellent control without foliage injury, two applications ($1\frac{1}{2}$–50) in one orchard at early pre- and early post-bloom reducing infection from 30·4 to 2·1 per cent. In another locality three applications of copper oxalate ($1\frac{1}{2}$–50) made in the early pre-, late pre-, and early post-bloom stages reduced infection from 36·2 to 7·3 per cent., treatments with Bordeaux mixture (2–1–50) permitting 13·7 per cent. infection.

In 1937, a plot of ten representative trees sprayed three times with copper oxalate (2–50) averaged 40·3 lb. of cured nuts per tree as against 24·7 lb. for trees of corresponding size in an adjoining plot given three applications of Bordeaux mixture (2–1–50), and 17·1 lb. for the unsprayed controls. In a further test, using copper oxalate (2–50) and Bordeaux mixture (2–2–50), the corresponding figures were 56·8, 53·9, and 46·9 lb.

It is tentatively concluded that under Oregon conditions, copper oxalate ($1\frac{1}{2}$ to 2 lb. per 50 gals.) gives better control of walnut blight than Bordeaux mixture (2–2–50), and that without injury to the foliage. Small-scale tests with this material by interested growers would appear to be warranted.

Miller (P. W.). **Studies on Filbert blight and its control: second report of progress.**—*Proc. Ore. St. hort. Soc.* (*1938*), xxx, pp. 166–171, 1939.

Owing largely to exceptionally rainy weather during the autumn and winter of 1937–8, filbert trees [*Corylus avellana*] in western Oregon were widely affected during the latter year by blight, due to a species of *Bacterium* [closely resembling *Bact. juglandis*: *R.A.M.*, xvii, p. 420], which caused losses of 5 to 35 per cent. of the trees in orchards up to three years of age, and an estimated crop loss in older orchards of 10 to 25 per cent. The attack reached its peak towards the end of April, and by early summer it was practically over.

Three applications of Bordeaux mixture (4–2–50), made in late summer (before the first autumn rains), in late autumn (when about half the leaves were off the trees), and in early spring (when the leaf buds were opening and the green tips of the leaves were showing) reduced bud and twig blight in bearing orchards to negligible proportions. The same programme is recommended when the critical period for infection (autumn and early winter) is very wet; in other years, one application in later summer or early autumn, before the first autumn rains, appears to suffice.

Darbellay (J.). **Constatations et réflexions sur le Pin Weymouth.** [Authenticated facts and reflections concerning the Weymouth Pine.]—*J. for. suisse*, xc, 2, pp. 25–29, 1 fig., 1939.

In connexion with an account of the white pine [*Pinus strobus*] stands of Vaud, particularly that of the Chanéaz, covering an area of 109 hect., the writer mentions a notable regression in the incidence of blister rust (*Peridermium strobi*) [*Cronartium ribicola*] since 1934, when the young polewood plantings were subjected to intensive clearing and all diseased individuals uprooted. These plantings had contracted infection from neighbouring currants, whereas the 50-year-old stands were comparatively resistant. To-day, thanks to energetic control measures, the equilibrium between the young and old populations is largely restored.

Carter (J. C.). **Coleosporium vernoniae on Pinus rigida in Illinois.**—*Plant Dis. Reptr*, xxii, 21, p. 433, 1938. [Mimeographed.]

Severe infection of nursery plants of *Pinus rigida* by the aecidial stage of *Coleosporium vernoniae* was observed in Union County, Illinois, in May, 1938. The rust occurred in a virulent form on a timber-covered hill a few hundred yards from the nursery and less destructively in the latter itself. Hosts of *C. vernoniae* previously reported from the State include *Vernonia baldwini*, *V. missurica*, *V. noveboracensis*, and *V. fasciculata*.

LIESE (J.). **Zur Frage des weiteren Anbaues der Douglasie in Deutschland unter Berücksichtigung der Adelopus-Nadelschütte.** [A contribution to the question of the further cultivation of the Douglas Fir in Germany in relation to the *Adelopus* needle-fall.]—*Mitt. dtsch. dendrol. Ges.*, li, pp. 212–218, 2 pl., 1 fig., 1938.

Summing up the available knowledge concerning the needle-fall (*Phaeocryptopus gaeumanni*) of the Douglas fir [*Pseudotsuga taxifolia*: *R.A.M.*, xviii, p. 75], the writer concludes that the further cultivation in Germany of this very valuable tree should be possible with strict attention to the selection of resistant types. A recent communication from Prof. Malcolm Wilson reports the presence of the fungus in British Columbia, Oregon, and Washington, where it causes abundant infection of Douglas fir along the coasts, though with little or no damage. Needle-fall was observed by the author and Frl. v. Gaisberg on a visit to Scotland, and severely infected material has also been received from Eire.

MACDONALD (J. A.). **Coniophora puteana (Schum.) Karst. on living Sequoia gigantea.**—*Ann. appl. Biol.*, xxvi, 1, pp. 83–86, 1 pl., 1939.

A fungus isolated from a 36-year-old tree of *Sequoia gigantea* felled in a garden at St. Andrews, Scotland, in 1936, was identified as *Coniophora puteana*. On malt, prune, and potato dextrose agars, the organism [*R.A.M.*, xvii, p. 282] grew at first white, silky, with prominent strands, becoming denser, woolly, with tangled, loose hyphae above the mat, the colour rapidly becoming tinged with yellow and finally patched with brown; the hyphae bore single, paired, and verticillate clamp-connexions; oidia were freely produced and appeared to be present in all cultures more than a fortnight old. The growth rate of colonies in tube culture, calculated over a period of 12 days, showed an average increase of 2·3 cm. in two days. Characteristic mycelial strands were prominent in the earlier stages of growth, and the thicker of them bore irregularly shaped, dark brown, sclerotioid structures, up to 2 mm. in diameter. Brown zone lines were also formed. The rot produced by the fungus in culture and in nature was characterized by horizontal cracks in the wood. The loss in weight of artificially infected blocks of *S. gigantea* due to the activity of the fungus amounted to approximately 17 per cent. This is believed to be the first record of a *Coniophora* on *S. gigantea*, and as the fungus was the only organism present it clearly acted as a primary parasite.

THOMAS (A. V.). **The prevention of 'blue stain' in Jelutong timber.**—*Malay. Forester*, viii, 1, pp. 18–21, 1939.

Planks of *Dyera costulata*, 3 in. thick, treated in different ways with various chemicals and then stacked for six months in the air, were found to dry satisfactorily without developing a serious amount of blue stain, believed to be due to *Diplodia* [*R.A.M.*, xv, p. 133]. Slightly better results were obtained generally with logs sawn up soon after arrival than with those sawn after 14 to 15 days in the open, and lignasan (0·2 per cent.) [ibid., xviii, p. 364] and sodium silicofluoride (1 per cent.) were slightly more effective than borax (5 per cent.). The last-named

was also found to be unsuitable for the treatment of piling stickers, whereas those treated with lignasan showed very little stain.

RABANUS (A.). **Über die Säure-Produktion von Pilzen und deren Einfluss auf die Wirkung von Holzschutzmitteln.** [On the acid production of fungi and its influence on the action of wood preservatives.]—*Mitt. dtsch. Forstver.* 23, pp. 77–89, 4 figs., 9 graphs, 1939.

Particulars are given of laboratory experiments demonstrating the production by *Polyporus vaporarius* [*Poria vaporaria*], *Polyporus sulphureus*, *Merulius domesticus* [*M. lacrymans*], *Fomes igniarius*, *F. annosus*, *Coniophora cerebella* [*C. puteana*], *Polystictus versicolor*, *Lenzites abietina*, and certain other wood-destroying fungi on 2·5 per cent. malt extract solution of sufficient quantities of oxalic acid to convert the copper carbonate formed from copper sulphate on treated telegraph poles into an insoluble copper oxalate innocuous to these organisms. The alleged inadequacy of the copper sulphate treatment of structural timbers on calcareous soils in Germany and Switzerland is attributed, not to any deleterious influence of lime *per se*, but solely to this faculty of certain lignicolous fungi for the production of oxalic acid.

KALLENBACH (F.). **Bemerkenswerte Hausschwammschäden.** [Noteworthy dry rot damage.]—*Z. Pilzk.*, N.S., xvii, 3–4, pp. 87–90, 2 pl., 1938.

Paxillus acheruntius [*P. panuoides*: *R.A.M.*, xvii, p. 641] is recorded as having caused considerable damage in a new house in Germany for which insufficiently dried timber had been used. It is suspected that the infection was introduced into the building on planks from which the bark had not been removed.

RICHARDSON (N. A.) & LARNER (E. E.). **Leaching tests on aqueous wood preservative mixtures containing alkali chromates.**—*J. Soc. chem. Ind., Lond.*, lviii, 2, pp. 66–69, 1 diag., 1939.

Details are given of the methods and results of leaching tests on Scots pine [*Pinus sylvestris*] wood blocks at the Forest Products Research Laboratory, Princes Risborough, Bucks., of the water-soluble wood preservatives, mercuric chloride, zinc chloride, copper sulphate, sodium arsenate, and sodium fluoride, each combined with potassium dichromate in appropriate proportions. The apparatus used was a modified form of Soxhlet extractor. The impregnation treatment consisted of a vacuum of 25 in. followed by a pressure of 90 lb. per sq. in., each for one hour.

The experimental data indicated that with certain salts, notably mercuric chloride, a substantial degree of fixation in wood (over 95 per cent.) can be obtained by the admixture of potassium dichromate. The extent of fixation was not appreciably reduced by the addition to the mixture of sodium nitrite to prevent the corrosion of metal. It is not possible at this stage, however, to deduce the chemical changes taking place as a result of contact between the treating solutions and the wood. They are certainly very complex and no doubt vary in the different mixtures. All the blocks treated with a solution containing potassium dichromate, either alone or in admixture with other salts, turned

brownish immediately after impregnation. On drying, however, the wood in some cases gradually assumed a greenish hue, suggesting the reduction of the potassium dichromate to a chromium salt. With solutions of a neutral or alkaline reaction, e.g., mercuric chloride with potassium chromate and sodium nitrate, the treated wood maintained a uniform yellowish-brown tint.

TOMPKINS (C. M.) & ARK (P. A.). **Club root of crucifers in California.**—*Plant Dis. Reptr*, xxiii, 1, p. 4, 1939. [Mimeographed.]

The first record of club root of crucifers (*Plasmodiophora brassicae*) in California appears to date from 1905, when the disease was reported on turnip [*R.A.M.*, xv, p. 547]. In 1938 it was present on semi-mature cauliflower-broccoli (*Brassica oleracea* var. *botrytis*) of the purple-heading type on a San Francisco farm, where infection is said to have commenced in 1931 on a small area of less than $\frac{1}{4}$ acre and since spread over six acres, affecting various crucifers.

TOMPKINS (C. M.). **A mosaic disease of Radish in California.**—*J. agric. Res.*, lviii, 2, pp. 119–130, 5 figs., 1939.

Since 1933, radishes in market gardens near San Pablo, California, have been affected by a mosaic disease characterized both under field and greenhouse conditions by small, roughly circular to irregular, chlorotic lesions between or adjacent to the veins, and later developing into a coarse mottle. After 10 to 14 days the normal leaf tissue appeared as irregular, non-raised islands on a conspicuous, yellowish-green chlorotic background. Little or no leaf distortion was present, though occasionally raised, dark green islands occurred on artificially inoculated plants in the greenhouse. Wild or escaped radish was ascertained to be highly susceptible, and is probably an important source of infection.

The virus was readily transmitted by rubbing, but attempted transmission by three aphids was uniformly unsuccessful. The incubation period ranged from 9 to 18 days. No variety of radish tested was resistant. The virus was transmitted to 19 species of plants belonging to 9 genera in 4 families, and was recovered from all except spinach. It was lethal to Virginian stock (*Malcomia maritima*) and evening scented stock (*Matthiola bicornis*), and occasionally to spinach, produced local chlorotic lesions on the leaves of *Nicotiana glutinosa* and tobacco, systemic chlorotic rings on *N. rustica* var. *humilis*, and systemic chlorotic and necrotic lesions on *N. langsdorffii*. Other susceptible hosts included *Brassica pe-tsai*, kale, Brussels sprouts, cabbage, sprouting broccoli, cauliflower, kohlrabi, black and white mustard (*B. nigra* and *B. alba*, respectively), turnip, Chinese mustard (*B. juncea*), Chinese radish (*Raphanus sativus* var. *longipinnatus*), several cruciferous weeds, and *Delphinium ajacis*. Annual stock (*M. incana* var. *annua*) was resistant.

The virus retained its infectivity after ageing for 14 days at 22° C., was inactivated by heating for 10 minutes at 68°, and caused infection in dilutions up to 1 in 14,000. It can readily be differentiated from other crucifer viruses by the symptoms it induces, its experimental host range, and its properties.

BRANDENBURG (E.). **Über die Grundlagen der Boranwendung in der Landwirtschaft.** [On the principles of boron application in agriculture.]—*Phytopath. Z.*, xii, 1, pp. 1–112, 20 figs., 6 graphs, 1938.

In this monographic study on the effect of boron on plant growth, the author points out that in experiments with beet the lack of boron led to a decline in the weight increment of the plant before any outward signs of infection appeared; later growth was arrested, and eventually the plant died off, though recovery took place when boron was introduced in time. Most of the boron taken up by the beet plant is deposited in the leaves, so that the older foliage of a plant may contain normal amounts of boron, while the younger, grown in a period of a subsequent boron scarcity, may contain small amounts only.

The results of sand culture experiments showed that the boron requirements of beets depend on the amount of other elements present, being higher the better the supply of other elements.

Analytical investigations again confirmed earlier conclusions that boron deficiency is responsible for heart and dry rot of beets. Leaves of such beets have a lower boron content than those of healthy beets from the same field, the difference being less noticeable in the root. Periods of summer drought and alkaline reaction of the soil, which were previously considered direct causes of heart and dry rot, are instrumental in diminishing the absorption of boron on poor soils. The addition of 20 or 30 kg. of borax per hect. controlled heart and dry rot, had a most favourable effect on the sugar content, and increased the yield by 30 or more per cent. From an analysis of healthy and diseased beet leaves it is concluded that the lower limit of boron deficiency lies at 100 mg. boric acid per kg. of dry substance, while it appeared from field experiments that 170 to 400 mg. per kg. of dry substance constitutes a normal and sufficient boron content. An analysis of the field experiments showed that the addition of 20 to 30 kg. borax per hect. to soil completely lacking in boron was just sufficient to give a normal boron content to the leaves. The addition of these amounts of boron to the soil does not usually raise the boron content of the plant immediately, and under adverse weather conditions it may take many years to reach that of normal plants. The amounts of boron contained in Chile saltpetre reduced the incidence of heart and dry rot in the field but did not suffice to control the disease in poor soils. Since the symptoms of boron deficiency appear in very young beet plants, the boron should be applied either shortly before or directly after planting. The varieties of fodder beet tested varied in their susceptibility to heart and dry rot.

The glassiness of fodder beets often occurring in North Germany is also considered to be a boron deficiency disease, being controllable by the application of 30 to 40 kg. of borax per hect. Species of *Brassica* are more sensitive to boron deficiency than species of *Beta* and show symptoms of infection much earlier.

WALKER (J. C.). **Internal black spot of Garden Beet.**—*Phytopathology*, xxix, 2, pp. 120–128, 4 figs., 1939.

Particulars are given of the writer's studies on internal black spot of canning beets in Wisconsin, and of preliminary experiments in its

control by means of soil treatments with borax, a note on which has already appeared from another source [*R.A.M.*, xviii, p. 366].

Roland (G.). **Onderzoekingen verricht in 1937 over de vergelingsziekte en enkele minerale gebreken bij de Biet en de Spinazie.** [Investigations carried out in 1937 on yellows disease and some mineral deficiencies in Beet and Spinach.]—*Tijdschr. PlZiekt.*, xlv, 1, pp. 1–22, 1 pl., 1939. [French summary.]

Continuing his studies at Wageningen, Holland, in 1937, on virus yellows of beet [*R.A.M.*, xv, p. 548; cf. also xviii, p. 226], the writer found that a single individual of the peach aphid (*Myzus persicae*) suffices to transmit the disease from an infected to a healthy plant. Viruliferous insects retain their infective capacity after a three days' sojourn on healthy plants. *Macrosiphum solanifolii* was also shown to act as a vector of the disease. The virus is not transmissible from yellowed to sound plants by mere root contact, and all attempts to communicate it directly by means of juice transference gave negative results; in one out of five tests, however, aphids artificially contaminated with the juice conveyed the disease to a healthy beet. Viruliferous aphids do not transmit the infective principle of yellows to their progeny. Certain varieties of fodder beets containing a high proportion of anthocyanin, e.g., Half Sugar Red Giant Claudia, were found to react to infection by the yellows virus by reddening of the foliage.

Experimental evidence is adduced that the externally very similar potato leaf roll and beet yellows are distinct, that the Président potato is not a host of beet yellows, nor do beets harbour the leaf roll virus. On the other hand, the transference of *Myzus persicae* from infected beets to spinach and reciprocally gave positive results. The features of the disease on spinach include foliar chlorosis, necrosis of the interveinal tissues of the older leaves, gummosis of the secondary phloem, and heavy accumulations of starch. The characteristic symptoms of yellows only develop in beets receiving a complete fertilizer and provided with a sufficiency of water.

Control measures against yellows were recommended in a previous paper by the writer and others [ibid., xviii, p. 79]. Attention is here further drawn to the necessity of a plentiful, though not excessive, supply of nitrogen to balance the potash and phosphorus of the fertilizer.

Blair (W. S.) & Leefe (J. S.). **Influence of lime in crop rotation with a note on the occurrence of boron deficiency in Mangels.**—*Sci. Agric.*, xix, 5, pp. 330–343, 1939.

In this paper it is stated that when potatoes were grown in western Nova Scotia in soil given different fertilizer treatments as well as an application of ground limestone at the rate of 2 tons per acre, the mean increase in yield in the limed plots over those not receiving lime amounted to 18·9 bush. per acre, but the incidence of scab [*Actinomyces scabies*: see above, p. 412] in the former was so great that the crop was unmarketable. Potatoes were not grown in the same plots until nine years later, when the incidence of scab was again high, though no further application of lime had been made in the intervening period.

Mangolds grown in limed and unlimed plots given (*a*) sodium borate

(10 lb. per acre), (*b*) nitrate of soda, superphosphate, slag, and potash, (*c*) magnesium sulphate (120 lb. per acre), and (*d*) copper sulphate (15 lb. per acre) showed, respectively, 2 and 0, 89 and 81, 85 and 73, and 89 and 77 per cent. heart rot (boron deficiency with *Phoma betae* as a secondary pathogen) and yields of (*a*) 926·8 and 409, (*b*) 265·4 and 185·1, (*c*) 280·7 and 297·6, and (*d*) 256·5 and 200·8 bush. per acre. The disease was almost eliminated by the small amount of boron applied, and while it was usually more severe in limed than in unlimed areas, provided the boron requirement was met, liming increased the yield.

WADE (B. L.) & ZAUMEYER (W. J.). **U.S. No. 5 Refugee, a new mosaic-resistant Refugee Bean.**—*Circ. U.S. Dep. Agric.* 500, 11 pp., 2 figs., 1938.

Extensive tests with the U.S. No. 5 Refugee bean, introduced in 1935, confirm that it is immune from common bean mosaic [*R.A.M.*, xviii, p. 289], besides possessing other desirable qualities [which are discussed in detail].

HEMMI (T.) & NIWA (S.). **On Botrytis rots of stored Onions.**—*Ann. phytopath. Soc. Japan*, viii, 4, pp. 309–326, 1 pl., 1 fig., 1939. [Japanese, with English summary.]

A full account is given of three very rare diseases of stored onions in Japan, mycelial neck rot (*Botrytis byssoidea*) [*R.A.M.*, xvii, p. 789], small sclerotial neck rot (*B. squamosa*) [loc. cit.], and a new disease caused by an undetermined species of *Botrytis*. All three were repeatedly reproduced by experimental inoculations through needle wounds.

Infection by *B. byssoidea* appeared to occur at all temperatures from 3° to 32° C., decay being most rapid at 10° to 24°. Even under the most favourable conditions the decay caused by *B. squamosa* proceeded much more slowly than that due to the other two organisms. The pathogenicity of the undetermined species was such that penetration of the unbroken cuticle of the succulent scales sometimes occurred; decay appeared to be most rapid at about 24°. Inoculations through needle wounds with conidia and conidiophores demonstrated conclusively that all the strains of *B. cinerea* isolated from strawberries, Satsuma oranges, and lettuces were able to infect the succulent scales of stored onions.

YARWOOD (C. E.). **Botrytis infection of Onion leaves and seed stalks.**—*Plant Dis. Reptr*, xxii, 21, pp. 428–429, 1938. [Mimeographed.]

During the past three years onion leaves and seed stalks in the San Francisco Bay region of California have been observed to bear oval, whitish or greyish, sterile lesions 1 to 10 mm. long, though on dead material spores of *Botrytis cinerea* were observed. Inoculations on greenhouse onions with either the latter or spores from pure cultures of *B. cinerea* from orchids resulted in three days in a white foliar spotting similar to that occurring on field plants [cf. preceding abstract]; in severe cases the lesions merged and caused wilting and finally the death of the leaves from the tip downwards. This onion disease would thus appear to bear a fundamental resemblance to the chocolate spot of broad beans (variously attributed to *B. cinerea* or *B. fabae* [ibid.,

xviii, pp. 646, 787]) and the recently described spotting of tomato fruits by *B. cinerea* [ibid., xvii, p. 633]. *B. allii* [ibid., xvii, p. 789], forming whitish, necrotic lesions all round the seed stalks, was prevalent in 1938 in the Santa Rosa district, causing an average of 16 per cent. infection in four fields and heavy losses of seed.

WEISE (R.). **Über die durch Fusarium culmorum (W.G.Sm.) Sacc. hervorgerufene Spargelfusskrankheit.** [On the foot rot of Asparagus caused by *Fusarium culmorum* (W.G.Sm.) Sacc.]—*Z. PflKrankh.*, xlix, 1, pp. 15–40, 1 fig., 3 graphs, 1939.

In 1937 foot rot of asparagus caused by *Fusarium culmorum* [*R.A.M.*, xvi, p. 364] is stated to have attacked 5 per cent. of all stands in Saxony, and up to 26 per cent. in one plantation at Weinböhla. The disease first appears in June or July and affects the older plants, young plants and wild stocks being attacked only following insect or other injury. The disease takes three different forms. In the first and most common, occurring in hot and dry weather, the stem is attacked from 10 to 15 cm. below soil-level and becomes pulpy and carmine-red, the green parts of the plant turning yellow and dying off. In the second form, occurring in wet weather, the stem is attacked at soil-level, the epidermis of the aerial portions gradually turns blackish-green or dark brown, and small, pink pustules develop within the stem, which becomes carmine-red and pulpy inside; the green parts of the plant turn yellow and die off. In the third, chronic form, the plants are attacked at the roots and the stems become carmine-red and pulpy at the base.

The green parts of the plant were found to remain free from the parasite, whereas masses of hyphae and spores could be detected inside the lower part of the stem. The hyphae spread normally in the vessels to about 30 cm. below and 50 cm. above the point of infection.

The fungus excreted in culture a substance toxic to asparagus, producing the same discoloration of the latter as in diseased plants and apparently being responsible for their death. This substance was not, however, toxic to oats. In pure culture *F. culmorum* grew rapidly over a range of P_H values from 3·2 to 8·4, and was indifferent to light. In confirmation of De Haan's results [ibid., xvi, p. 806] the optimum temperature for growth was found to lie between 20° and 25° C. In artificial infection experiments all wounded plants were attacked by the fungus and showed the usual symptoms of the disease, whereas only a small percentage of the uninjured plants became infected and in these a slight wound was usually afterwards discovered to be present. In most cases the fungus entered the plant through the stem and not the root.

Soil samples from the Weinböhla district showed the universal presence of *F. culmorum* at all depths. The fungus can survive as a saprophyte on dead asparagus tissue, in the upper layers of new compost piles, and in straw. Comparative measurements of soil humidity and temperature showed that conditions favourable to its development (a temperature of 20° to 27° and sufficient humidity), occur inside the asparagus beds during dry, hot weather, and at the surface during wet summer weather or in the autumn. When the mounds, formed by earthing-up, and usually left intact at Weinböhla till the end of summer,

were removed in alternate rows directly after cutting, infection was reduced from an average of 4·4 to 7·2 per cent. to one of 1·0 to 1·7. The removal of the mounds directly after cutting is therefore recommended, especially as it would entail no appreciable additional expense. Soil disinfection is believed to be too costly and difficult to apply. Dead and infected plant remains and stubble should be carefully removed and burnt in order to prevent the formation of spores. A sufficient supply of potassium, phosphorus, and particularly humus should be ensured. So far all varieties of asparagus have been found to be equally susceptible to the fungus.

PAUL (W. R. C.) & FERNANDO (M.). **The effect of manuring on the incidence of Chilli leaf curl.**—*Trop. Agriculturist*, xcii, 1, pp. 23–28, 1 fig., 1939.

In the dry zone of Ceylon, pepper (*Capsicum frutescens*) is widely affected by a form of leaf curl differing from that recently reported by Park and Fernando [*R.A.M.*, xviii, p. 273], characterized by the adaxial curling of the leaves, and by a buckling of the interveinal areas due to the inability of the veins to keep pace with the extension of the leaf surface. The affected leaves remain small and the fruits are malformed. The internodes fail to reach their maximum length and the plants appear bushy. The disease is not caused by a deficiency of the soil in nitrogen and organic matter and may possibly be due to insect injury or a virus.

Amtliche Pflanzenschutzbestimmungen. [Official plant protection regulations.]—*Beil. NachrBl. dtsch. PflSchDienst*, xi, 1, pp. 24–38, 45–47, 1939.

JAPAN. The Japanese quarantine regulations, promulgated on 25th March, 1914, and here amended and brought up to date (1938), prohibit the importation of sugar-cane and parts thereof (including seeds) from Taiwan (Formosa), the South Sea Islands, and all foreign countries in order to prevent the introduction of downy mildew or Australian leaf stripe (*Sclerospora sacchari*), and of Solanaceae or parts thereof (including fresh fruits and tubers) with a view to the exclusion of wart disease (*Synchytrium endobioticum*).

RUMANIA. A list, dated 3rd March, 1938, is given of 41 fungal, bacterial, and virus diseases regarded as constituting a danger to cultivated crops and henceforth to be the subject of special prophylactic measures.

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xiii, 2, pp. 29M–30M, 1939.

GERMANY (PRUSSIA). By a decree dated 31st October, 1938, and dealing with potato virus diseases, the planting of peach and apricot trees is forbidden in certain parts of Pomerania. Further, peach and apricot trees must be watched for the appearance of *Myzus persicae* and those which, in spite of obligatory treatment with carbolineum become infected, must be sprayed immediately before or after flowering with a preparation recognized as efficacious by the central plant protection service [*R.A.M.*, xviii, p. 133].

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Johnpulle (A. L.). **Chilli leaf-curl experiments. I. Preliminary infection tests.**—*Trop. Agriculturist*, xcii, 1, pp. 28–30, 2 pl., 1939.

Experimental evidence is adduced showing that the leaf curl of chilli as described by Park and Fernando [*R.A.M.*, xviii, p. 273] is caused by an undetermined species of thrips.

Miller (L. I.). **Control of leafspot of Peanut with copper and sulphur fungicides.**—*Plant Dis. Reptr*, xxiii, 1, pp. 5–6, 1939. [Mimeographed.]

Good control of leaf spot of groundnuts (*Cercospora*) [*arachidicola* and *C. personata*: *R.A.M.*, xviii, p. 236] was obtained on 45 trial plots on sandy loam soil at Holland, Virginia, in 1938 by the following treatments: three applications of either Bordeaux mixture 8–12–100, lime-sulphur 2 in 100, with or without catalytic sulphur 4 in 100, or four proprietary sulphur dusts (98 to 100 per cent. through 325 mesh); two of Bordeaux followed by one of wettable sulphur (6·5 in 100); and one of Bordeaux followed by two of wettable sulphur. Severe foliar burning, however, was caused by lime-sulphur. The average increase of yield in field tests in six counties involving 30 plots of $\frac{1}{4}$ to $1\frac{1}{4}$ acres in extent dusted with sulphur as compared with the corresponding controls was 23·5 per cent.

Roldan (E. F.) & Querijero (A. F.). **Black spot of Peanut.**—*Philipp. Agric.*, xxvii, 8, pp. 669–682, 6 figs., 1939.

The most prevalent and destructive disease of groundnuts in the Philippine Islands is black spot (*Cercospora personata*) [see preceding abstract]. The disease, which is always present at Los Baños, causes early death of the plants as a result of repeated defoliation. All attempts to isolate the fungus, using tissue and single-spore methods and employing a variety of media, failed to give any growth. Field studies showed that the organism persists in the soil from one season to the next as stromata in the dead refuse of diseased groundnuts, which may be covered with a protective layer of soil. The stromata produce fresh conidia as conditions become more favourable, and these conidia cause primary infection. Observations on plants grown from seeds from diseased groundnuts showed that *C. personata* is not seed-borne. Evidence is adduced that infection in the field is due to spores carried by the wind from the soil or from leaves of diseased plants. Of eight

varieties tested by being planted in infected fields none showed less than about 80 per cent. infection. The best hope of control lies in the development of resistant strains.

Mackie (J. R.). **Annual Report on the Agricultural Department, Nigeria, 1937.**—38 pp., 1939.

Groundnut rosette [*R.A.M.*, xvii, p. 725] has tended to become more prevalent in recent years in the Kano Province of Nigeria. Incidence varies from year to year, but when heavy causes a considerable reduction of yield. The results obtained in the first year of a series of experiments designed to ascertain whether the disease can be checked by cultural methods indicated that weeding after the plants had become well established was of small advantage, for the disease spread in the weeded, and decreased in the unweeded plots, though the yield of the former was increased. Diseased plants in the weeded plots tended to outgrow the disease when the rainfall was good, whereas those in the unweeded plots remained stunted longer, but the infection did not spread.

Passecker (F.). **Meine Erfahrungen mit der Kultur des Shiitake.** [My experiences with the culture of Shiitake.]—*Z. Pilzk.*, N.S., xvii, 3–4, pp. 100–101, 1 pl., 1938.

In attempts to culture *Cortinellus shiitake* [*R.A.M.*, xv, p. 72] the fungus was grown on wood shavings from spores received from Japan and inoculum placed in holes drilled in blocks of red beech wood, stored in a rather damp cellar. The first fructifications appeared over two years later; the caps measured up to 7 cm. in diameter and were almost white. It is pointed out that under Austrian conditions cultures would suffer from lack of moisture in the field and that, therefore, cellars and similar rooms offer more promising surroundings.

Watanabe (T.). **Studies on the fire-blight disease of Udo Salad plant.**—*Ann. phytopath. Soc. Japan*, viii, 4, pp. 271–297, 13 figs., 1939. [Japanese, with English summary.]

Aralia cordata, the udo salad plant of Japan, becomes affected in late spring by a disease producing on the stem ellipsoidal or spindle-shaped, often confluent, brown spots measuring 3 to 11 by 1 to 2 mm., which later show a greyish-brown centre and a violet-brown border. Reddish-violet spots develop on the leaf blade, midrib, and petiole, and the leaves and flowers wither and dry up. The spherical or subspherical, dark brown pycnidia are mostly formed on the upper surface of the spot and measure 37·5 to 150 μ in diameter (75 to 300 μ in culture); they have a round ostiole, which perforates the epidermis, measuring 10 to 20 μ in diameter. The hyaline pycnospores are ellipsoidal or tapering at one extremity and measure 3·75 to 6·25 by 2·5 to 3·75 μ. Inoculation experiments on wounded leaves and stems of *A. cordata* with pycnospores grown in Richards's agar gave positive results, the incubation period for the disease being about 7 to 10 days. The fungus is named *Phoma araliae* Cooke & Massee var. *microspora* Watanabe, n.var. [with a Latin diagnosis].

Vidal (J. L.). **À propos des traitements de la chlorose calcaire.** [On the subject of treatments against lime-induced chlorosis.]—*Progr. agric. vitic.*, cx, 51, pp. 518–520, 1938.

The author states that in his view a maximum of 12 l. of the 30 per cent. iron sulphate and 6 per cent. citric acid solution should be amply sufficient to swab 1 hect. of pruned vine stocks in the winter against lime-induced chlorosis [*R.A.M.*, xvii, p. 792]. On this basis he calculates the cost of materials for treatment as fr. 19·20 per hect., and contrasts this outlay with an increase in yield resulting from a single application of the solution in 1935 of 17·15 and 17 hectol. wine per hect. in the two following years, respectively, i.e., a financial profit of fr. 5,100.

In a brief note on p. 520, J. Branas states that in practice at least 80 l. of the solution are required per hect., at a cost of fr. 123, compared with fr. 13 for materials for treatment with 35 per cent. iron sulphate alone. He questions whether the expense of the citric acid is justifiable.

Herschler (A.). **Kupfer und Arsen in Weinbergsböden und Reben.** [Copper and arsenic in vineyard soils and Vines.]—*Wein u. Rebe*, xxi, 1–2, pp. 1–17, 1939. [Italian and French summaries.]

Analyses of the clay-slate soils of the Moselle vineyards and of the wood and foliage of the Riesling vines cultivated therein lent no support to the view that the infinitesimal quantities of copper and arsenic accumulating in the uppermost layer of 25 cm. from repeated treatments against disease (e.g., *Peronospora* [*Plasmopara viticola*: *R.A.M.*, xviii, p. 232]) may be responsible for the obscure physiological disturbances observed locally for several years past. No deleterious effects on the vines from this source are anticipated.

Scherz (W.). **Zur Immunitätszüchtung gegen Plasmopara viticola.** [On breeding for immunity from *Plasmopara viticola*.]—*Züchter*, x, 9–11, pp. 299–312, 4 figs., 2 graphs, 1938.

After referring to the history of breeding vine varieties resistant to *Plasmopara viticola* [*R.A.M.*, xviii, p. 727], the author describes the breeding methods adopted at Müncheberg, Mark Brandenburg, Germany. Of first importance is the so-called '*Plasmopara* analysis', in which the F_1 generation hybrids between E (= European vine: *Vitis vinifera*) and A (American vines). or their reciprocals, and their back-crosses to E are sown in pots, and when the second leaf is developed artificially infected under optimal conditions in a special glasshouse. According to the degree of resistance shown by the hybrids, they are classified in five groups and the resistant ones (which usually amount to about 20 per cent.) are then grown in large-scale plantings. From these resistant individuals are again selected after artificial infection and planted in the field, where they are kept under observation for several years in regard to their resistance to other parasites, winter-hardiness, yield capacity, and quality. The most satisfactory in all these respects are increased to three stocks each, and the seedling population raised from them again submitted to '*Plasmopara* analysis' in order to find individuals of more or less homozygotic resistance. Such stocks, as well as F_1 forms exhibiting similar behaviour, are then back-crossed to the best German *V. vinifera* varieties.

The F_2 population of the hybrid Riparia × Gamay 595 Oberlin selected in this way showed complete resistance even in the years of optimal conditions for the development of the parasite, and it maintained this resistance to all populations of the fungus tested in special glasshouses at Müncheberg as well as under natural conditions in Italy, Rumania, and Turkey, a result indicating that *P. viticola* does not incline to form specialized races. This F_2 population, of which 35,000 stocks are now present at Müncheberg, exhibits great variation in the shape of the grapes and leaves, and in yielding capacity; only 18·2 per cent. were free from the typical 'grassy' taste of the American Riparia vines, a clear correlation existing between the grassy taste and the American habit. The *Plasmopara* analysis of F_1 and F_2 of E × A showed that only a few individuals among them are suitable for back-crossing.

Attempts to achieve immunity by interbreeding *V. vinifera* vines failed until it was discovered that only certain European varieties were suitable, and 300 entirely resistant *V. vinifera* seedlings were obtained, indicating that *V. vinifera* also has a gene for immunity.

BRANAS (J.). **Chronique. Choix des greffons et court-noué.** [Current notes. Choice of grafts and court-noué.]—*Progr. agric. vitic.*, cxi, 1, pp. 3–8, 3 figs., 1939.

The author points out that court-noué disease of the vine [*R.A.M.*, xviii, p. 294] is liable to be spread by the unwitting use on the part of growers of grafts which themselves show slight symptoms of the disease, e.g., fasciation, abnormal forking, or double nodes. In some cases it may be advisable for growers to obtain grafts from localities in which the disease seldom, if ever, occurs, such as areas free from *Phylloxera* [*vastatrix*], certain sandy coastal districts, and localities where the vines are very old and every year are subjected to flooding.

VOELKEL (H.) & KLEMM (M.). **Die wichtigsten Krankheiten und Schädigungen an Kulturpflanzen im Jahre 1938. (Beobachtungs- und Meldedienst der Biologischen Reichsanstalt.)** [The most important diseases and injuries of cultivated plants in the year 1938. (Observation and warning service of the Reich Biological Institute).]—*Beil. NachrBl. dtsch. PflSchDienst*, xix, 2, 31 pp., 4 graphs, 71 maps, 1939.

This fully detailed survey of the incidence and geographical distribution of the diseases and other injuries affecting cultivated plants in Germany in 1938 has been prepared on similar lines to those of previous years [*R.A.M.*, xvii, p. 375].

BAUDYŠ (E.). **Zpráva o škodlivých činitelích v hospodářském roce 1937–1938 v zemi Moravskoslezské.** [Report on pests and diseases during the agricultural year 1937–1938 in the Moravian-Silesian district.]—*Ochr. Rost.*, xv, 2, pp. 12–19, 1 fig., 1939. [German summary.]

This report records the diseases of economic crops occurring in 1937–8 in the Moravian-Silesian district of Czechoslovakia.

VIELWERTH (V.). **Choroby a škodci kultúrnych rastlín zapadného a strednébo Slovenska za hospodársky rok 1937–1938.** [Diseases and pests of cultivated plants in western and central Slovakia during the agricultural year 1937–1938.]—*Ochr. Rost.*, xv, 2, pp. 19–23, 1939. [German summary.]

This is a brief account of well-known diseases and pests of economic crops recorded in Slovakia during 1937–8.

FIALA (F.). **Zpráva o škodlivých činitel'och kultúrnych rastlín na východ. Slovensku a Podk. Rusi v hospodárskom r. 1937–1938.** [Report on diseases and pests of cultivated plants in eastern Slovakia and Carpathian Ruthenia in the agricultural year 1937–1938.]—*Ochr. Rost.*, xv, 2, pp. 23–26, 1939. [German summary.]

This is an account of pests and diseases of economic crops in the Czechoslovakian districts of eastern Slovakia and Carpathian Ruthenia during 1937–8.

UPPAL (B. N.). **Appendix K. Summary of the work done under the Plant Pathologist to Government, Bombay Presidency, Poona, for the year 1936–37.**—*Rep. Dep. Agric. Bombay, 1936–7*, pp. 219–227, 1938. [Received April, 1939.]

This report [cf. *R.A.M.*, xvi, p. 588] contains, among others, the following items of interest. Effective control of betel vine [*Piper betle*] wilt [chiefly caused by *Phytophthora* sp.: ibid., xi, p. 283 *et passim*] followed spraying with Bordeaux mixture (2–2–50) at planting time (October–November), in May before the monsoon, and on three further occasions at intervals of one month between June and September. One application of sulphur (200 mesh) at the rate of 30 lb. per acre made in January gave control of betel vine powdery mildew [? *Oidium* sp.: ibid., xvi, p. 588] in newly planted gardens. In old gardens two applications are necessary, and should be made in November and January. Betel vine anthracnose [ibid., xiv, p. 718] has become very prevalent in recent years in the Deccan; yellowish, irregular spots develop on the leaves, from which a species of *Gloeosporium* was isolated [cf. ibid., xvii, p. 445]. Affected leaves turn yellow and fall. The disease was associated with root infestation by nematodes.

POLE EVANS (I. B.). **Pasture, crop and insect problems of the Union. Annual Report of the Division of Plant Industry for the year ended 31 August, 1938.**—*Fmg S. Afr.*, xiii, 153, pp. 519–538, 11 figs., 1938.

The following are among the items of phytopathological interest in this report [cf. *R.A.M.*, xvii, p. 441]. Investigations on the factors conducive to waste in stored lemons showed that the stage of maturity at which the fruit is picked is more important in this connexion than the temperature maintained between a range of 40° to 55° F., the liability to decay increasing parallel with ripeness. For instance, fruit from an eastern Transvaal packing-house at a silver to yellow colour developed 33·9 per cent. wastage, the incidence of which among lemons from the same orchard gathered at the green to silver stage being only 6·8 per cent. Attention is drawn to the risks attendant on the indiscriminate

washing of citrus fruits, even with approved disinfectants, the value of which is largely counteracted by the detrimental effects of increased handling, additional opportunities of contamination, and weakening of the rind.

A careful inspection of 91,761 orchard and 3,700 nursery trees in the citrus canker [*Pseudomonas citri*] danger zone revealed no trace of infection, and the disease may now be definitely stated to be non-existent in South Africa [ibid., xvii, p. 848]. Out of 745,037 trees examined for the presence of scaly bark or psorosis [loc. cit.] in the western Transvaal and Cape Province, 1,363 (0·18 per cent.) showed symptoms of the disorder.

Wemmershoek apples stored in ordinary wrappers contracted severe scald at 31°; the incidence of the trouble was appreciably reduced by the use of oiled wrappers over a four-month period, with the disadvantage, however, of extensive pitting in 5 to 25 per cent. of the fruit.

An abnormal drop of young litchi [*Nephelium litchi*] fruits was associated with infection by a *Pestalozzia* responsible for a serious rot of the ripe fruit [ibid., xiv, p. 426], which therefore presumably originates during or soon after flowering.

The Co. 281 sugar-cane variety has proved highly resistant to streak.

Helminthosporium turcicum caused a mild form of leaf blight in maize and kaffir corn [sorghum; ibid., xv, pp. 201, 344, 746], the former also suffering from ear rots due to *Fusarium* spp.

A pink discoloration of groundnut shells was also attributed to a species of *F.* (? *F. angustum*, the agent of similar damage on a previous occasion), while an olive-green tinge developing simultaneously was induced by a fungus which failed to grow beyond the pycnidial stage. A buff-coloured growth round the kernels was identified as the mycelium of *Rhizoctonia*.

Polyporus lucidus [*Ganoderma lucidum*] was responsible for a 'falling-over' tendency in *Acacia karroo* trees in the Fountains valley near Pretoria. A characteristic blue-green *Penicillium* was isolated from the grey-black discoloured wood of imported aspen [*Populus tremula*] logs, which were thereby spoilt for the purpose of match and matchbox manufacture.

New diseases included *Colletotrichum* spp. on granadilla [*Passiflora edulis*], cucumber, and *Tripteris*, the first-named contracting stem rot and the other two leaf spots, *Cercospora richardiaecola* causing leaf spot of *Arum* [*Zantedeschia aethiopica*], and *Fusarium* rot of bananas.

THOROLD (C. A.). **Annual Report of the Plant Pathologist on Coffee research at Mount Elgon.**—*Rep. Dep. Agric. Kenya, 1937*, ii, pp. 35–41, 1939.

Observations on the effect of an artificial shade canopy of split bamboos constructed over two acres of established coffee in Kenya showed that it appreciably reduced the incidence of Elgon die-back [*R.A.M.*, xvii, p. 640], confirming the view that adequate shade effectively controls the disorder. Experimental evidence demonstrated that removal of all the leaves from a coffee tree, thus creating carbohydrate deficiency in parts of the tree, is followed by typical Elgon die-back, even in shaded trees. Observations made on a large number of *Coffea*

arabica trees indicated that differences in susceptibility depend upon the fact that Elgon die-back is associated with a particular, prodigal growth habit and with premature loss of leaves.

On p. 19 of this report S. Gillett states that in spraying tests conducted from 1934 to 1938, inclusive, coffee trees sprayed with 1 per cent. carbide-Bordeaux in March, with the same mixture in March and June, with ½ per cent. carbide-Bordeaux on the same dates, and with Burgundy mixture yielded, respectively, averages of 9·27, 9·77, 7·21, 9·99, and 9·05 cwt. of clean coffee per acre, as against only 4·11 cwt. for the unsprayed control.

In the botanical section (pp. 55–61), Thorold gives a report by F. W. Evans stating that sixteen samples of wheat rust [*Puccinia graminis*] from different parts of Kenya were tested and the form present determined in 15 of them: K1 was obtained from one locality, K2 from seven localities, and K4 from five, while a suspected new form, K5, was recorded on 58. F. (L. 1) from three. Other tests indicated that Kenya Governor, Einkorn [emmer], and Reliance are resistant to the new form, 112 and 58. F. (L. 1) susceptible, and Kenya Standard on the borderline.

Seed dusting of the Redwing variety of linseed before planting with three mercurial dusts, agrosan G, Rd 8521, and Rd 8522, gave increased yields over the controls, the improvement being statistically significant in the case of the two last-named, which also increased the percentage of germination by 20 to 30 per cent.

Plant pathology and physiology.—*Rep. Tex. agric. Exp. Sta., 1937*, pp. 95–121, 1938. [Received April, 1939.]

This report [cf. *R.A.M.*, xvii, p. 590] contains the following items of interest. J. J. Taubenhaus and G. M. Watkins succeeded in practically inhibiting the growth of *Phymatotrichum omnivorum* on cotton [ibid., xviii, p. 175] by mixing samples of Miller clay loam, Yahola very fine sand, and Houston black clay soils with 2·5 per cent. of crude petroleum by weight.

G. E. Altstatt reports that a very low percentage of over 10,000 seeds from wilt-infected tomato plants germinated when plated and none of them produced colonies of *Fusarium* [*bulbigenum* var.] *lycopersici* [ibid., xviii, p. 234]. The fungus was found to have retained its viability in most of the dead, dry, wilt-infected tomato plants stored in the open shed since 1933, 1935, and 1936.

P. A. Young, describing the results of field tests with 44 varieties of tomato, states that resistance to *F. bulbigenum* var. *lycopersici* [ibid., xviii, p. 237] combined with desirable commercial qualities was found to exist in Louisiana Pink, Louisiana Red, Blair Forcing, Marvel, Marglobe, Michigan State, Sureset Forcing, Rutgers, Kanora, Prairiana, Illinois Pride, and Long Calyx Forcing. In tests with Greater Baltimore tomatoes the application of chloropicrin to the soil gave 90 to 100 per cent. control of *F. bulbigenum* var. *lycopersici* in the plots covered with glue-coated paper, and 81 to 94 per cent. in those watered after treatment.

P. A. Young, G. E. Altstatt, and A. L. Harrison report that spotted wilt of tomato [ibid., xviii, p. 235], first reported from south-western Texas in 1935, has become more prevalent.

G. T. Boyd obtained satisfactory control of die-back of roses [chiefly due to a species of *Diplodia*: ibid., xvii, p. 683] in the field by pruning off the flower buds before they opened. The application of sprays or dusts was not essential, but appeared to reduce infection somewhat when plants were not pruned.

G. T. Boyd and E. W. Lyle state that approximately 92 per cent. control of black spot (*Diplocarpon rosae*) [ibid., xvii, p. 821] was obtained on the Luxembourg rose with a dust containing 300-mesh sulphur and cuprocide, and a spray composed of Bordeaux mixture, wettable sulphur, and kayso. The best results were obtained when the removal of flower buds before opening was practised in conjunction with treatment by the fungicides. J. J. Taubenhaus found that the spores of *D. rosae* from infected rose leaves collected at fortnightly intervals from January to May remained viable for six weeks, the green leaves yielding more viable spores than the yellow ones.

G. T. Boyd found that the best adherence of cuprocide sprays, as determined by the sodium diethyl dithiocarbamate method of colorimetric analysis, was obtained by the use of commercial lethane spreader, other valuable compounds being dry areskap [ibid., xvii, p. 122], aresklene [ibid., xviii, p. 446], SS-3, wettable sulphur, and corikal N powder. The effect of a given spreader on the distribution of copper sprays upon foliage, as determined by the leaf-print method, varied little with the different copper compounds; spreaders superior in adherence were not necessarily superior in distribution. Spreader SS-3, lethane, wettable sulphur, aresket 240, and aresklene increased the toxicity of cuprocide, whereas kayso and dry ortho definitely reduced it.

A. L. Burkett found that 2 per cent. ceresan used at rates of 1 to 8 gm. per l. of nutrient medium inhibited the growth of damping-off fungi (*Pythium* sp. and *Rhizoctonia* sp.) in pure culture. Cuprocide, copper 'KB', and zinc oxide AAZ [ibid., xvii, p. 365] gave satisfactory control of the growth of the organisms when used at the higher rates, the first two being more effective on *Pythium* than on *Rhizoctonia*.

J. J. Taubenhaus and A. L. Burkett obtained effective control of preemergence damping-off of bush beans [*Phaseolus vulgaris*], beets (fodder and sugar), carrots, cotton, eggplants, groundnuts, hollyhocks, peas, peppers [*Capsicum* spp.], radishes, sorghum, spinach, sweet peas, tomatoes, and cucurbits by seed treatment with cuprocide. In the control of sore shin and damping-off of cotton cuprocide was less effective than 2 per cent. ceresan.

W. N. Ezekiel demonstrated that *Pythium arrhenomanes* [ibid., xvii, p. 735 and below, p. 448], isolated from sorghum seedlings and used for greenhouse inoculations in April, killed varieties both resistant and susceptible to the root and crown rot disease in the field, whereas in inoculations in May and June it produced no definite symptoms on any of the plants.

Forty-eighth Annual Report for the fiscal year ended 30th June, 1938.— *Bull. Wash. St. agric. Exp. Sta.* 368, 103 pp., 1938. [Received April, 1939.]

The section of this report dealing with plant pathology (pp. 59–67) [*R.A.M.*, xvii, p. 504] contains the following items of interest, apart

from those already noticed from other sources. In work by C. S. Holton, F. D. Heald, and E. F. Gaines during 1937, at least one new race of *Tilletia tritici* [*T. caries*] and *T. levis* [*T. foetens*] was identified, bringing the number of recognized races up to 12 for *T. caries* and 9 for *T. foetens* [ibid., xvii, p. 804]. The 'short smut' race of *T. caries* [ibid., xvii, p. 505], which has caused heavy losses in Klickitat County, Washington, southern Idaho, northern Utah, and the Gallatin Valley of Montana was found for the first time in the Panhandle of Idaho, bordering on the Palouse country of south-eastern Washington.

Evidence obtained with *T. caries* and *T. foetens* demonstrated that even with monosporidial lines, race differentiation on a basis of cultural characteristics is unreliable. It was also found that hybrids between races within the same species had spores morphologically similar to the parent species. The spores of interspecific hybrids were smooth in some instances and reticulate in others. In tests for pathogenicity made with five hybrids between T_9 and L_8, segregation of factors for spore wall characters was noted. Two new selections from the cross Oro × Turkey-Florence were highly resistant to all races of bunt except L_8. Thatcher was the most susceptible of the spring wheats tested, being infected by 18 out of 19 races used in the tests, while Hope was the most resistant. Thirty-one races of *Ustilago avenae* and *U. levis* [*U. kolleri*] were tentatively identified.

Tests by F. D. Heald and R. Wellman with different aqueous solutions for the control of *Penicillium expansum* [ibid., xvii, p. 794] on punctured apples showed that 0·1 per cent. potassium dichromate, either in aqueous solution or in 1 per cent. hydrochloric acid, inactivated the spores in one minute. When used to wash apples, 0·4 per cent. potassium dichromate dissolved in 1 per cent. hydrochloric acid gave commercial control of *P. expansum* when allowed to act for 35 seconds.

Tests by G. W. Fischer of 160 collections of grasses for susceptibility to head smut (*U. bullata*) [ibid., xvii, p. 825] indicated the existence of many well-defined physiologic races of the fungus, each with a restricted host range, and showed varietal differences in susceptibility among some grass species. Culture experiments with 17 collections of *U. bullata* showed that most of the pathogenically different collections are culturally different, while those which resemble one another pathogenically are also similar in cultural behaviour; the collections differed widely in type, rate, and colour of growth, and monosporidial cultures of opposite sex from the same chlamydospore often differed materially in growth type. The evidence demonstrated that no two races or collections of *U. bullata* can necessarily be regarded as closely related merely because they parasitize species of the same genus of grasses. There was marked compatibility between some collections, while others failed to show even sporidial fusions.

In spore germination studies of *U. striaeformis* [loc. cit.] on grasses the fresh spores repeatedly showed 80 to 100 per cent. germination on nutrient agar. Inoculation tests demonstrated that *U. striaeformis* causes the seedling type of infection.

Isolations by L. Campbell from sugar beet black root [ibid., xvii, p. 506] yielded 31 different species or strains, inoculation tests with which resulted in typical symptoms only with a species of *Phoma*.

Good control of the pre-emergence stage only of the disease resulted from the addition of ceresan or formaldehyde dust to the fertilizer in the drill at planting. The evidence indicated that black root can be economically controlled by a crop rotation in which some cultivated crop other than beet is grown for the first year after a sod crop (clover, lucerne, grass, or mixtures). In one field of sugar beet the percentage of crown rot was much reduced and yield significantly increased by the use of 10 to 40 lb. of borax per acre, the value of the treatments increasing proportionately with the quantity of borax used.

Good control of bean [*Phaseolus vulgaris*] rust (*Uromyces appendiculatus*] [ibid., xvii, p. 427] in fields under overhead irrigation followed one to six applications of 1 in 100 lime-sulphur spray and 1 in 100 stopfire (the Saanichton KS-resin spray), the greater part of the protection afforded being given by the late applications.

Inoculation experiments by L. K. Jones showed that the viruses of geranium crinkle and mosaic [ibid., xvii, pp. 506, 684] are not transmitted by mechanical contact of injured plants, but are increased in the plantings through propagation from diseased plants.

Observations on trial plantings of Newburgh, Lloyd George, Taylor, Marcy, Indian Summer, and Latham raspberries showed that the last-named became affected with mosaic [ibid., xvii, p. 506] while the others remained healthy. In one locality the Newburgh variety has remained virus-free though grown beside affected Cuthbert raspberries for four years.

Department of Botany.—*Rep. Pa agric. Exp. Sta., 1937–8* (*Bull.* 367), pp. 31–35, 1 fig., 1938. [Received April, 1939.]

In this report [cf. *R.A.M.*, xvii, p. 378], E. L. Nixon states that three hybrids of the Richard Peters pear, which appears to be immune from fireblight [*Erwinia amylovora*: ibid., xvii, pp. 379, 401], were crossed with Bosc and fruited heavily. When artificially inoculated with *E. amylovora* in the blossoms and twigs one developed slight twig blight, while the others remained unaffected. Nearly 400 crosses of Richard Peters with standard varieties are now being grown.

W. S. Beach states that in 1937 tobacco wildfire [*Bacterium tabacum*: ibid., xvii, p. 379] was widespread and severe in Lancaster county. There was no significant difference in the degree of infection between plots given high nitrogen–low potash and others given low nitrogen–high potash fertilizer, or between plots with different degrees of soil acidity (P_H 5·1 to 6·2). Adjacent rows of maize reduced the severity of wildfire by about a half. Infection was experimentally transferred to healthy tobacco by means of flea-beetles [*Epitrix parvula*: ibid., xv, p. 613].

J. W. Sinden found that the addition of soil to mushroom [*Psalliota* spp.] compost increased yields. The best crop was obtained when 900 lb. soil were added to each ton of manure. Some slight advantage appeared to be given by adding the soil at the end of the composting.

Fiftieth Annual Report of the Rhode Island State College Agricultural Experiment Station.—44 pp., 1938. [Received April, 1939.]

The addition of oiled paper to packages of apples in Rhode Island to

control storage scald [*R.A.M.*, xvii, p. 691 and above, p. 438], which seriously affects several varieties, including Rhode Island Greening, has not proved entirely successful. The results of experimental pickings of Rhode Island Greening apples on 1st, 4th, 8th, 11th, 15th, and 23rd September 1936, packed with and without oiled paper, demonstrated that, while the use of the oiled paper reduced scald, by far the most important factor in controlling the condition was the date of picking, the number of apples free from scald increasing from 29 to 79 per cent. when harvesting was postponed from 1st to 23rd September.

In further investigations on the influence of sprays upon the activity of apple leaves [cf. ibid., xvii, p. 445], applications of kolofog (6 to 10 lb. per 100 gals.) did not lead to any reduction in assimilation.

When Marglobe tomato plants in the field were sprayed with various materials, the lowest percentage of dead leaves (death resulting from spray injury with or without early blight due to *Alternaria solani*) was given by Bordeaux mixture 12–4–50 (containing free copper); Bordeaux mixture (4–4–50), the same plus 1·5 per cent. volck nursery oil [ibid., xvi, p. 714], copper oxychloride, and Bordeaux mixture (4–12–50) showing increasing percentages of dead leaves. An application of 4 lb. hydrated lime in 50 gals. water produced no apparent injury until rain fell about a week after the spraying, whereupon all the plants were at once killed. Plants sprayed with Bordeaux mixture (4–4–50) at 8 p.m. made the greatest growth, followed (in order) by those sprayed at 8 a.m. and 2 p.m. Night spraying reduces spray injury while still adequately controlling disease.

Early blight (*A. solani*) was of great importance in destroying the foliage of field tomatoes in 1937. In several instances, leaf infection reached nearly 100 per cent., and on one occasion at least crop failure resulted. The destructiveness of the disease appears to be increasing, and no commercial variety shows any marked resistance. In field spraying and dusting tests red copper oxide (cuprocide 54) used as a spray ($3\frac{1}{2}$ lb. per 100 gals.) checked infection and gave the least visible residue. Cuprous oxide-lime dust (10–90) gave good control, while the vines sprayed with cuprocide or Bordeaux mixture (4–4–50) retained the green colour of their foliage until late in the season and had the largest amount of green fruit when the plants were cleared on 23rd September.

Club root of cabbage (*Plasmodiophora brassicae*) was completely controlled by application to the soil (in holes) of chloropicrin [ibid., xvi, p. 720], whereas the controls showed an average of 23 per cent. diseased plants.

Pure culture studies of *Botrytis elliptica* [ibid., xvi, p. 752], which caused a total loss of an estimated crop of 50,000 lily blossoms, indicated that spores are formed only under cool, moist conditions. The mycelium and sclerotia remained viable after several months' storage adjacent to the freezing unit of a refrigerator.

Laboratory tests on the toxicity of about 50 fungicides to the spores of *Sclerotinia fructicola* showed that copper fungicides were about equally toxic at 18° and 29° C. Bordeaux mixtures (4–4–50, 4–2–50, 4–0–50, and 2–4–50) with hydrated lime all gave over 97 per cent. inhibition of germination, and the 4–2–50 mixture over 99 per cent. Hydrated lime and water (4–50) averaged 15·5 per cent. inhibition.

Certain proprietary brands of copper fungicides, especially the 'dry Bordeaux mixtures', with one exception, permitted over 50 per cent. germination. Cuprous oxide and copper oxychloride, as a spray, or combined with lime as a dust, gave over 96 per cent. inhibition. Some sulphur fungicides were as toxic at 18° as at 29°, but others were 47 per cent. more toxic at the higher temperature than at the lower. Liquid lime-sulphur (1 in 50) gave over 97 per cent. inhibition. Various proprietary substances, all labelled 'dry lime-sulphur', used at the rate of 4 lb. per 100 gals. of water allowed 3 to 52 per cent. germination. Some types of colloidal sulphur, used at a rate of 6 lb. per 100 gals., gave under 10 per cent. germination, but many others at rates of 8 to 16 lb. per 100 gals. allowed 50 to 95 per cent. It would appear to be urgently important that standards of toxicity should be formulated for fungicides.

Three applications (or enough to keep the trees covered) of Bordeaux mixture (4–4–50) made to the new growth of juniper trees and seedlings gave complete control of *Phomopsis* blight [? *P. juniperovora*: ibid., xvi, p. 299].

Silayan (H. S.). **Annual Report of the Director of Plant Industry, Commonwealth of the Philippines, for the fiscal year ending December 31, 1937.**—182 pp., 21 pl., 2 graphs, 1938. [Received March, 1939.]

The section of this report [cf. *R.A.M.*, xvi, p. 659] dealing with plant pathology (pp. 68–75) contains, *inter alia*, the following items of interest. During the period under review, maize in the Philippine Islands was affected by *Sclerospora philippinensis* [ibid., xv, p. 794], *Ophiobolus heterostrophus* [ibid., xvii, p. 432], and *Helminthosporium inconspicuum* [*H. turcicum*: ibid., xvii, p. 15 and above, p. 438], of which the first was the most destructive, causing stunting and sterility in 5 to 90 per cent. of the plants in some fields. Carrots were infected by *Macrosporium carotae* [ibid., xv, p. 632] and *Sclerotium rolfsii* [ibid., xi, pp. 298, 349]. No eggplant variety tested was completely immune from *Phomopsis* [*vexans*: ibid., xviii, p. 370], but Pampanga White was very highly resistant, as well as being very resistant to bacterial wilt [*Bacterium solanacearum*], though the fruits were extremely susceptible to *Phytophthora melongenae* [*P. parasitica*: ibid., v, p. 205; xvii, pp. 699, 796]. The Lemery and Iloilo Purple varieties were moderately resistant to combined attacks of all three diseases.

Selections of Irish potato from strains which effectively withstood late blight [*Phytophthora infestans*] in 1936 again proved highly resistant under field conditions and gave two or three times the yield of the susceptible Japanese white variety. Baguoi Selection No. 8 was classified as very highly resistant, while Baguoi Selections Nos. 1, 2, 3, 4, and 5 (sister tubers) were classified as resistant to slightly susceptible. In other field tests, Sutton's Command and Glasgow Favourite were quite resistant, and May Queen and Inverness Favourite very susceptible.

The Narcisa strawberry variety was very highly resistant to leaf spot [*Mycosphaerella fragariae*].

The results obtained in tests with abacá [*Musa textilis*] for varietal resistance to bunchy top [ibid., xviii, p. 256] indicated that it may be

possible to rehabilitate the industry by planting resistant varieties. The Putian variety averaged 96 per cent. resistance, as against 14 to 78 per cent. for other varieties tested. At present, about 10,000 healthy plants are available for planting purposes. In 1935, 1,000 healthy rootstocks of Putian were planted for trial purposes, and so far they have resisted attack.

ISRAILSKI (V. P.) & CHISTOSERDOVA (Mme G. V.). Серодиагностика некоторых флюоресцирующих фитопатогенных бактерий. [Serodiagnostics of some fluorescent phytopathogenic bacteria].—Микробиол. [*Microbiol.*], vii, 7, pp. 809–828, 3 figs., 1938. [English summary.] [Received May, 1939.]

Several strains of *Bacterium* [*Pseudomonas*] *citriputeale* [*R.A.M.*, xv, p. 575] were isolated from branches of lemon and tangerine trees affected by blast [ibid., xvii, p. 812] and studied in comparison with other strains of the same organism from various districts of U.S.S.R. and with other bacteria. Meat peptone agar plus malachite green (1 : 100,000) was found to be a very suitable culture medium because it arrested the growth of spore-bearing and saprophytic bacteria, but allowed the development of fluorescent pathogenic bacteria, almost all of which formed the same characteristic type of colony with a wavy margin and a slightly uneven surface. The majority of the strains of *P. citriputeale* liquified gelatine, peptonized and alkalized milk, and failed to form acids from sugars (excepting a few strains on glucose), while some strains were divergent in their biochemical properties and later proved to differ also in their serological properties and pathogenicity. The bacteriophage from *Bact. xanthochlorum* [ibid., xvi, p. 339] and that from *P. citriputeale* isolated from tangerine dissolved all bacteria belonging to the fluorescent group but no other. Sera of rabbits immunized against *P. citriputeale* agglutinated all strains of this bacterium and some of *Bact. tabacum*, while sera immunized against *Bact. mori* agglutinated most of the strains of *P. citriputeale* and some of *Bact. tabacum*. Strains of *P. citriputeale* aberrant in their biochemical properties were not agglutinated by sera of either *P. citriputeale* or *Bact. mori*. It is assumed from a certain inconsistency in the serological data that some of the fluorescent bacteria contain a mixture of antigens, of which some are specific and others non-specific for the given bacteria. Of the strains of *P. citriputeale* only those with the biochemical and serological properties typical for this bacterium proved pathogenic to the branches, leaves, and fruits of lemons, whereas the aberrant strains and also *Bact. mori*, *Bact. tabacum*, and *Bact. xanthochlorum* were not pathogenic.

SOLACOLU (T.), CONSTANTINESCO (M.), & CONSTANTINESCO (T.). **Action de la colchicine sur les tumeurs végétales provoquées par le Bacillus tumefaciens.** [The action of colchicin on plant tumours induced by *Bacillus tumefaciens*.]—*C.R. Soc. Biol., Paris*, cxxx, 11, pp. 1148–1150, 1939.

In experiments at the Faculty of Pharmacy, Bucharest, Rumania, the development of crown gall tumours (*Bacterium tumefaciens*) in *Pelargonium zonale* and *Ricinus communis* was arrested by application of a lanoline paste containing 0·50 to 0·75 per cent. colchicin [*R.A.M.*,

xvii, p. 661], the inhibitory action of which is stronger on young than on older outgrowths and increases parallel with the duration of the treatment. The mechanism of the arrested growth and necrosis of the tumours consists in the formation, in the subero-phellodermic layer, of a meristem separating the sound from the diseased tissues and so interrupting the biological continuity between the pathogen and its host.

Brown (Nellie A.). **Colchicine in the prevention, inhibition, and death of plant tumors.**—*Phytopathology*, xxix, 3, pp. 221–231, 2 figs., 1939.

Attempts were made to prevent the inception of crown gall (*Bacterium*) tumours, to inhibit growth already begun, and to kill mature excrescences in various hosts of the organism by different methods of treatment with colchicin [see preceding abstract]. The initial development of galls was prevented only in a few cases, i.e., 2 *Chrysanthemum frutescens* out of 15, 4 *Tagetes patula* out of 18, 1 tomato out of 14, and 2 beans (*Phaseolus vulgaris*) out of 7, by stem injections with 0·2 to 0·5 c.c. of a 2 per cent. solution, and in 3 *C. frutescens* and 2 beans out of a total of 84 plants treated by the insertion of a lip of the basal stem in a 0·06 to 2 per cent. colchicin solution for several hours before inoculation. Out of a total of 305 tumours on *C. frutescens*, *T. patula*, *Nicotiana glauca*, *Kalanchoë daigremontiana*, and *Bryophyllum pinnatum*, 239 were inhibited and eventually died as the result of a single brushing with colchicin (mostly at a strength of 2 per cent.); however, none of the 49 tomato galls included in this series succumbed to the treatment. The hosts were in no way adversely affected by the application of colchicin. Indoleacetic acid tumours similarly treated ceased to develop but were not destroyed.

Bennett (F. T.). **Fusarium disease of cereals.**—*J. Minist. Agric.*, xlv, 11, pp. 1115–1118, 3 figs., 1939.

This is a popular account of the diseases of cereals caused by species of *Fusarium* [*R.A.M.*, xv, p. 6] which were responsible for considerable losses in 1938 in England, where winter wheat is most frequently attacked while barley may also suffer severely (up to 75 per cent. loss in the seedling stage in one instance). The different symptoms are described and the following suggestions made for control. Expert advice should be sought where a crop shows signs of ill health; if there is no reason to the contrary stubble should be ploughed under deeply, using the skim coulter; seeds of doubtful origin and poor appearance should not be used and all should be treated with one of the mercurial dusts; and finally, good growing conditions should be provided with regard to surface drainage, tilth, firm bottom, and proper time of sowing.

Beilin (I. G.). Эпифитии ржавчин на Пшенице за последние годы на северном Кавказе и факторы, способствовавшие их возникновению и развитию. [Recent Wheat rust epidemics in North Caucasus and factors favouring their outbreak and development.] —*Bull. Acad. Sci. U.R.S.S., 1938*, Sér. biol., 5–6, pp. 995–1016, 1938. [English summary.] [Received April, 1939.]

Russian breeding work is stated to have been until recently mainly concerned with the development of hardy, prolific, and drought-resistant wheat varieties without much attention being paid to their

reactions to smut and rusts. Thus, the most popular Russian standard wheats, Caesium 0111, Erythrospermum 341, Durable, Ukrainka, Kooperatorka, and Hostianum 237, are all highly susceptible to *Tilletia tritici* [*T. caries*], *Puccinia triticina*, *P. graminis*, or *P. glumarum*, while several of the best oats are very susceptible to *P. coronifera* [*P. lolii*]. The climatic conditions of North Caucasus, with its 3,000,000 hect. of winter wheat land, permit the overwintering of the rusts, and the relatively high day temperatures in June and abundant rainfall and dew in May and June facilitate their rapid development. The use of susceptible varieties under these conditions and the absence of correct crop rotations led to severe rust epidemics in North Caucasus in the years 1932 to 1937, lowering the quality of the grain and reducing the yields in some years and districts to about half the normal.

Milan (A.). **Sul 'carbone volante' del Grano in rapporto all' accestimento delle piante.** [On loose smut of Wheat in relation to tillering.] —*Nuovo G. bot. ital.*, N.S., xlvi, 1, pp. 149–157, 1939.

In continuation of his earlier investigations [*R.A.M.*, xvi, p. 239] the author found in large-scale experiments during 1935 to 1938 with seed of wheat varieties artificially infected with loose smut (*Ustilago tritici*) that thickness or thinness of sowing exercised virtually no effect on the percentage of plants that became infected, but very greatly affected the percentage of ears that became diseased. Any condition that increased tillering lowered the percentage of ears that became diseased. Thus, to cite a few examples, in infections made in 1935, the percentage of infected ears from Mentana wheat sown thinly was 85, while that of plants sown thickly was 95·4, the corresponding figures for Fam. 96 Todaro being 61·9 and 80·6. In the infections made in 1936, Mentana wheat sown thinly gave 71·4 per cent. infected ears; but when five and ten times as many grains were sown in the same area the percentages of infected ears were, respectively, 78 and 83·4. With the Rachael variety thin and thick sowings gave 68·8 and 77·5 per cent. infected ears respectively. In the third year, Rieti n. 11 Todaro sown thinly gave 60·5 per cent. infected ears, the latter figure rising to 80·5 per cent. when sowing was five times, and to 86 per cent. when it was ten times, as thick. In any variety the percentage of infected plants was invariably higher than that of infected ears. Tests in containers demonstrated that the percentage of plants infected was the same as the percentage of ears infected only when no tillering took place.

These experiments show that in experiments on the varietal resistance of wheat to *U. tritici* serious errors may occur if the ability of the plants to tiller is not taken into consideration.

Milan (A.). **Sensibilità per la Ustilago tritici (Pers.) Jens. di alcuni ibridi normali di Frumento.** [The susceptibility to *Ustilago tritici* (Pers.) Jens. of some normal hybrids of Wheat.]—*Riv. Pat. veg.*, xxix, 1–2, pp. 71–84, 1939.

In four years' field experiments carried out in Italy on the susceptibility of wheat hybrids to *Ustilago tritici* the author made direct and reciprocal crosses between (*a*) two susceptible parents, (*b*) one susceptible and one resistant, (*c*) one resistant and one susceptible, and (*d*) two

resistant, and made floral inoculations at the time of crossing with the chlamydospores of the fungus collected in the locality where the tests were made.

Determinations [which are tabulated] of the percentage of affected plants and ears shown by the F_1 generation (normal hybrids) of the crosses and each of the parents demonstrated that of the parent varieties tested, Mentana, Gentile rosso mutico, Rieti 11 Todaro, Fam. 96 Todaro, Rachael, and Grano 28 ottobre are highly susceptible. Damiano Chiesa, Virgilio, and Carlotta inalletabile are moderately susceptible, and Federation × Khapli and Littorio highly resistant. The reaction of the F_1 progeny of direct and reciprocal crosses was the same. All the crosses of very susceptible with very resistant parents gave normal hybrids, whose resistance was practically complete, such resistance being a dominant character. Normal hybrids from two very susceptible or very resistant parents showed the same type of reaction as the parents. The percentage of infected plants was constantly much higher than the percentage of infected ears [see preceding abstract], and in experiments on the reaction of wheat hybrids to *U. tritici* the percentage of affected plants and not ears should be determined. There was no evidence of matroclinous or patroclinous inheritance.

Glynne (Mary D.). **III. Eyespot lodging of Wheat caused by Cercosporella herpotrichoides Fron.**—Reprinted from *Agric. Progr.*, xvi, 1, 5 pp., 1939.

Eyespot lodging of wheat (a name approved by the Plant Pathology Committee of the British Mycological Society) results from infection with *Cercosporella herpotrichoides* [*R.A.M.*, xv, p. 433; xviii, p. 98], though lodging due to other causes (e.g., non-parasitic factors, Hessian fly [*Mayetiola destructor*], *Fusarium culmorum*) seldom occurs in England, where the importance of the disease only began to be recognized in 1937, when it was prevalent in different localities. At Rothamsted in 1937–8 the fungus was found sporing freely on stubble left lying in the field after ploughing, suggesting that infected stubble is the main carrier of infection to the subsequent crop. After about the middle of April spores did not seem to occur on diseased lesions on plants in the field, and this scarcity of spores has made it very difficult in the past to diagnose the disease. When 80 per cent. or more of the culms were infected, lodging was severe; at lower percentages it was less severe or confined to individual culms. Both wheat and barley were most severely affected when sown in winter, spring sowings escaping serious infection. Oats appeared to be practically immune. In England, as in other countries, the disease is favoured by moist growing conditions and by repeated cropping. The effect of fertilizers rich in nitrogen in increasing the incidence of the disease was observed in the field at Rothamsted, where it was more marked in 1937 than in 1938.

Graham (V. E.) & Greenberg (L.). **The effect of salicylic aldehyde on the infection of Wheat by Pythium arrhenomanes Drechsler, and the destruction of the aldehyde by Actinomyces erythropolis and Penicillium sp.**—*Canad. J. Res.*, Sect. C., xvii, 2, pp. 52–56, 1 fig., 1939.

The results of pot experiments with wheat conducted in Saskatche-

wan, showed that the addition of salicylic aldehyde at the rate of 50 p.p.m. to soil before sterilization and subsequent inoculation with strain SH_2 of *Pythium arrhenomanes* [see above, p. 440], the fungus primarily associated with browning root rot of wheat, intensified the injury caused by the fungus [cf. ibid., xvii, p. 488]. The effect of salicylic aldehyde seemed to be on the plant rather than on the fungus, as it was shown that the organism could not grow on a medium containing 10 p.p.m. of the substance, an amount which was without effect on the wheat. Grown on a mineral salt-salicylic aldehyde medium, *Actinomyces erythropolis* and a species of *Penicillium* (probably *P. rivolli*), isolated from the soil of a healthy area of a partially infected field, were found to destroy salicylic aldehyde. It is suggested that when unfavourable soil conditions inhibit the growth of organisms that are capable of destroying salicylic aldehyde or other substances acting in a similar manner, such substances may accumulate in the soil and thus predispose wheat to attacks of *P. arrhenomanes*.

LEDINGHAM (G. A.). **Studies on Polymyxa graminis, n.gen., n.sp., a Plasmodiophoraceous root parasite of Wheat.**—*Canad. J. Res.*, Sect. C., xvii, 2, pp. 38–51, 5 pl., 3 figs., 1939.

This is an expanded account of studies on the life-history of *Polymyxa graminis*, a preliminary note on which has already appeared [*R.A.M.*, xii, p. 358]. The fungus has since been found on wheat plants in the Vineland Horticultural Station and isolated from the soil at the Agricultural College Farm, Guelph, Ontario. The large, multinucleate zoosporangia of the fungus are stated to develop from uninucleate amoebae by progressive lobular outgrowths. The resting spore clusters are formed by segmentation of naked, multinucleate myxamoebae without the formation of a soral membrane. The smooth, yellow-brown, spherical or many-sided resting spores measure 5 to 7 μ in diameter. Zoosporangia and resting spores produce identical zoospores, 4 to 5 μ in diameter, each with one short and one long flagellum. The process of penetration has not been observed, but it is thought that the entire amoeba passes into the cell as described by Miss Curtis for *Synchytrium* [ibid., i, p. 80]. English and Latin diagnoses are given of the new genus and species.

ELLIOTT (CHARLOTTE) & ROBERT (ALICE L.). **Tripsacum dactyloides, another native host of Aplanobacter stewarti.**—*Phytopathology*, xxix, 3, pp. 284–285, 1939.

Attention is drawn to the occurrence of bacterial wilt (*Aplanobacter stewarti*) on *Tripsacum dactyloides* of Texan origin growing at Arlington, Virginia, in proximity to a plot of infected susceptible maize [*R.A.M.*, xviii, p. 244]. No inoculations were made, but the *T. dactyloides* leaves bore numerous injuries inflicted by the flea-beetle, *Chaetocnema pulicaria*, in the course of feeding. The yellow bacteria isolated from the brown streaks, 1 to 3 in. by 1 to 3 mm., produced typical wilt symptoms on a susceptible line of maize. Repeated field and greenhouse inoculation experiments with *A. stewarti* on *T. dactyloides* and three other *T.* spp. gave exclusively negative results, and no natural infections have previously been observed. Probably, however, the small, inconspicuous

lesions produced by the pathogen on *T. dactyloides* are present every year.

Diachun (S.). **The effect of some soil factors on Penicillium injury of Corn seedlings.**—*Phytopathology*, xxix, 3, pp. 231–241, 1939.

In tests at the Kentucky Agricultural Experiment Station *Penicillium oxalicum* induced severe stunting of maize seedlings raised from kernels with damaged seed coats when the kernels were inoculated with a spore suspension or planted in soil contaminated with the fungus [*R.A.M.*, xiv, p. 355]. The extent of the injury on wounded and inoculated kernels was reduced by pressure into contact with very wet soil. *P.* sp. (K3), isolated from a diseased ear in the field, and *P. notatum* [ibid., xvii, p. 519; xviii, p. 173] afforded wounded kernels a degree of protection against soil infection by *P. oxalicum*, though no antagonism was apparent between the organisms in culture. The protective action of K3 and *P. notatum* was enhanced by heavily inoculating the grain with these species, and also by their introduction 24 hours before planting the seedlings in soil infested by *P. oxalicum*. The sooner after germination the injured kernels were inoculated with *P. oxalicum*, the greater was the damage inflicted. This fungus produced a toxic substance on Richards's solution and on autoclaved and living kernels. *P. notatum* and K3 neither formed toxins nor damaged wounded and inoculated kernels planted in sterile greenhouse soil.

Baker (R. E. D.). **The control of scab and certain other diseases and pests of Grapefruit by fungicides and insecticides.**—*Trop. Agriculture, Trin.*, xvi, 2, pp. 31–34, 1939.

Notes are given on the chief diseases of grapefruit and their control, by spraying under the conditions prevailing in Trinidad. The different spraying programmes usually adopted are described, and the paper concludes with a description of the best known types of stationary and mobile spraying apparatus.

Klotz (L. J.) & Fawcett (H. S.). **Isolation of Phytophthora spp.**—*Phytopathology*, xxix, 3, pp. 290–291, 1939.

The isolation of *Phytophthora citrophthora* and *P. parasitica* from citrus gummosis cankers, affected twigs, and diseased nursery stock [*R.A.M.*, xviii, pp. 103, 308] is apt to be complicated by extraneous contamination of the material, but pure cultures may readily be secured by the following method. The infected bark is thoroughly cleansed in running water, and the specimen then supported on hardware cloth [wire netting] at the top of a glass container with the diseased portion touching the water but not immersed. After three or more days in the running water, mycelium of *P.* spp. and other fungi will have grown out from the bark, and by the end of five days or a week the former will usually have produced sporangia. Freshly picked lemons in the silver or early tree-ripe stages are placed on the hardware cloth with the diseased specimen and zoospore formation induced by substituting water cooled to 15° C. for the tap water. These organs soon invade the lemon rind and typical brown rot ensues in four to seven days. The fruit is then removed and the decay allowed to proceed until complete permeation

by the *Phytophthora* hyphae is accomplished, but stopping before the intrusion of secondary *Penicillium* spp. The surface of the lemon is then flame-sterilized, the fruit cut open, and its seeds aseptically transferred to glucose potato agar or some other suitable medium, which has invariably yielded pure cultures of *P. citrophthora* and *P. parasitica* in the writers' cases of active gummosis.

THOMAS (K. M.) & MARUDARAJAN (D.). **Some aspects of the control of koleroga or mahali disease of the Areca Palm.**—*Madras agric. J.*, xxvi, 11, pp. 435–438, 1938.

The best control of koleroga disease [*Corticium koleroga*] of areca nut palms [*Areca catechu*: *R.A.M.*, viii, p. 258] in experiments in South Kanara in 1936 was given by two applications of 1 or 2 per cent. Bordeaux mixture, the addition of ½ gall. coco-nut oil or 2 lb. casein being helpful, especially in the case of the lower strength. Cuprous oxide was less effective. The total costs of the chemicals and adhesives required for the treatment of 500 trees with 50 gals. 2 per cent. Bordeaux mixture (1) plain, (2) with resin, (3) with oil, and (4) with casein were Rs. 2·3, 3·3, 2·4, and 2·7, respectively.

BLISS (D. E.). **The Penicillium disease of ornamental Palms.**—*Proc. fifth W. Shade Tree Conf., 1938*, pp. 20–27, [? 1938].

The author tentatively suggests that *Penicillium vermoeseni*, causing diseases of *Phoenix canariensis*, *Washingtonia filifera*, and *Cocos plumosa* [*R.A.M.*, xv, p. 91], is synonymous with *Penicillium roseum* [ibid., xiii, p. 481]. In unpublished notes filed at the Citrus Experiment Station, W. T. Horne (1913) and C. O. Smith (1917) attributed the disease of *W. filifera* to *P. roseum*; H. S. Fawcett (1924, 1930) isolated the same fungus from *Phoenix canariensis*; and E. L. Reeves (1926) demonstrated the pathogenicity of *Penicillium roseum* to *W. filifera* by inserting the fungus through wounds in the leaf bases of the palm and obtaining lesions in 5 out of 12 inoculations, two of which again yielded *P. roseum*. The disease is described as producing discoloured linear streaks on the leaves of *Phoenix canariensis*, the pinnae becoming yellowish brown and dying; blister-like pustules may form on the dead leaves. The disease seems to spread by contact from one leaf base to another, death of the palm occurring when the terminal bud is invaded. On *W. filifera* local necrotic areas form and enlarge rapidly on the young, tightly folded leaves in the crown of the palm, the infection spreading by contact from one folded leaf to the next one below it. Stunted and deformed leaves, retarded terminal growth, and great masses of rose-coloured spores between the layers of leaves are characteristic of the disease. Vigorous individuals of this species may recover. On *C. plumosa* the cankers formed on the trunks may remain very inconspicuous for several years. On date palms the disease is usually observed in association with the *Diplodia* disease. Generally speaking, the *Penicillium* disease occurs in California along a fairly narrow strip of coast from Mexico to the region of San Francisco Bay, where the ornamental plantings are more or less seriously affected, and in the south of the State. It seems to be of importance only in districts with predominantly cool and moist climate. For the control of the disease the substitution of the resistant *robusta* variety

for *W. filifera* proper and the removal of trunk cankers of *C. plumosa* at an early stage are recommended.

De Fluiter (H. J.). **Enkele minder bekende wortelschimmels van Koffie en Rubber.** [Some less familiar root fungi of Coffee and Rubber.]—*Bergcultures*, xiii, 8, pp. 236–243, 7 figs., 1939.

In the course of field inspections carried out in Java from 1935 to 1938 the writer made the following observations on some comparatively little known root fungi of coffee and rubber. An *Armillaria*, presumably *A. fuscipes* [sometimes regarded as *A. mellea*: *R.A.M.*, xiv, p. 454], was prevalent on coffee in plantations at altitudes of 1,300 to 1,600 m. above sea-level, the incidence of infection increasing parallel with the rise in elevation. The presence of the fungus may be recognized by the development of the usual characteristic longitudinal fissures up to 165 cm. in length on the stems, giving rise to the popular name of 'split canker'. Fruit bodies were neither observed in nature nor produced in culture. Control measures should consist in the early eradication and destruction of diseased bushes; cleaning of infected sites, which should be left fallow for a year before replanting; isolation of foci of disease by trenches 60 cm. in depth, enclosing a circle of healthy bushes besides the infected ones; and the application of sulphur to the plant holes shortly before or at planting.

In 1938 the fruit bodies of *Polyporus rugulosus* [ibid., xvi, p. 788], considered by Prof. Boedijn to be identical with *P. zonalis* [ibid., xv, p. 471; xvii, p. 88], were found in profusion on the root-collars and fallen leaves of rubber seedlings, but the fungus did not act as a parasite in the cases under observation, the wood remaining perfectly sound and no trace of penetration being detected.

Rubber bud grafts on an estate at the foot of the Raoeng mountains were attacked in 1937 by a species of *Rhizoctonia*, placed by Prof. Boedijn near *R. crocorum* [*Helicobasidium purpureum*], which caused the death of the cortex of the roots.

Bitancourt (A. A.). **Lesões nas frutas da mancha anular do Cafeeiro.** [Ring spot lesions on Coffee berries.]—*Biologico*, v, 2, pp. 33–34, 1 fig., 1939.

Attention is drawn to the recent detection on coffee berries in São Paulo, Brazil, of concentric chlorotic lesions, 1 to 6 mm. in diameter, tending to coalesce and become depressed in the later stages of the disease, which is tentatively attributed to a virus of the [tomato] spotted wilt group. Out of 50 berries collected at random, 14 were severely and 22 mildly affected.

Tharp (W. H.) & Young (V. H.). **Relation of soil moisture to Fusarium wilt of Cotton.**—*J. agric. Res.*, lviii, 1, pp. 47–61, 1 fig., 3 graphs, 1939.

Details are given of greenhouse experiments at the Arkansas Agricultural Experiment Station, in which was studied the relation of soil moisture (ranging from 20 to 100 per cent. of the water-holding capacity) to the incidence and severity of the *Fusarium vasinfectum* wilt of cotton [*R.A.M.*, xviii, p. 248] at the prevailing greenhouse tempera-

tures, and in one series at constant soil temperatures of 23°, 26°, 29°, and 32° C. All the tests were made on the susceptible Harper Mebane cotton variety, and the resistant Rhyne Cook was also used in one experiment. All the results with the susceptible variety showed a positive correlation of the disease with rise in moisture content to an optimum of 80 to 90 per cent., above which the correlation was negative up to 100 per cent. For the resistant variety there was little correlation of plants actually wilted with soil moisture content, total infection showing an irregular increase with rise in soil moisture over the entire range of moisture employed, with no relative reduction of disease from 90 to 100 per cent. of soil saturation. The P_H value of the inoculated soil at the different moisture levels underwent readjustment, until at the end of two experiments it showed a positive correlation with the moisture content; the fact, however, that the moisture level producing the highest percentage of disease caused but a slight change from the original P_H value would suggest the possibility that relative soil moisture and the P_H value of the soil may have an interrelated influence on the disease. In the constant soil temperature series the results further indicate the possibility of a similar combined effect on the wilt of soil moisture and soil temperature.

Yeager (C. C.). **Empusa infections of the House-Fly in relation to moisture conditions of northern Idaho.**—*Mycologia*, xxxi, 2, pp. 154–156, 1939.

In studies on the infection of the house fly by the fungus *Empusa muscae* [*R.A.M.*, xviii, p. 140], conducted over a period of 17 months in 1936–7 at Moscow, Idaho, the presence of the fungus was determined by inducing conidial germination in flies, by glueing them to a pane of glass and inverting this over a moist chamber, or by placing the flies in various nutrient solutions. The prevalence of *E. muscae* infections was found to be directly correlated with the amount of rainfall; during a very wet June 43·6 per cent. of the 220 flies examined were found infected, while from July to November, with little rainfall, only 0·5 per cent. of the 600 flies examined showed any infection.

Hornbostel (W.). **Kann Beauveria densa (Link) auch die Eier des Maikäfers befallen?** [Can *Beauveria densa* (Link) also attack the eggs of the Cockchafer?]—*Z. PflKrankh.*, xlix, 3, pp. 142–144, 3 figs., 1939.

Beauveria densa is known to attack the larvae, nymphs, and adults of the cockchafer [*Melolontha melolontha*: *R.A.M.*, xviii, p. 107], and the writer carried out experiments at the Bonn (Germany) Phytopathological Institute to determine the capacity of the fungus for infection of the eggs. Virulent strains of the organism, isolated from the mummies of infested cockchafers, grew well on various standard media, of which bouillon agar proved to be particularly suitable. Out of eight eggs inoculated with conidial suspensions of *B. densa* on 1st August, 1938, four were stored at 10° and the remainder at 22° to 27° C.; twelve days later all in the former lot and three out of the four in the latter bore the mycelium of the fungus and exuded a milky fluid on light pressure. In most cases reisolations from the egg surface

gave rise to characteristic cultures of *B. densa*. Coremia of the *Cordyceps* type were produced on the diseased eggs after four to six weeks at room temperature.

Drechsler (C.). **A few new Zoöpagaceae destructive to large soil rhizopods.**—*Mycologia*, xxxi, 2, pp. 128–153, 7 figs., 1939.

Latin and English diagnoses and full descriptions are given of three further species of Zoöpagaceae [*R.A.M.*, xvii, p. 597; cf. ibid., xviii, p. 310] destructive to large soil rhizopods and occurring in decayed plant remains in the United States, namely: *Cochlonema megalosomum* n.sp. destructive to *Amoeba verrucosa*, *C. bactrosporum* n.sp. destroying *Heleopera sylvatica*, and *Acaulopage marantica* n.sp. capturing and consuming *Amoeba terricola*.

Wolf (F. T.). **Sawada's discovery of Achlya flagellata as a parasite of fish.**—*Mycologia*, xxxi, 2, pp. 236–237, 1939.

Referring to a previous paper on the parasitism of *Achlya flagellata* on fish [*R.A.M.*, xvii, p. 319] the author wishes to correct the statement that this parasitism had not been previously known. It has since come to the author's knowledge that Sawada had published in 1912, entirely in Japanese, a report on the fungus *Achlya prolifera* parasitic on fish, this species being regarded by the author and by other workers as identical with *A. flagellata*.

Caldwell (J. T.) & Roberts (J. D.). **Rhinosporidiosis in the United States: report of a case originating in Texas.**—*J. Amer. med. Ass.*, cx, 20, pp. 1641–1644, 5 figs., 1938.

Clinical details are given of a case of rhinosporidiosis in a 16-year-old schoolboy in Texas, associated with the presence in a polypus in the right side of the nasal septum of the perfectly round, encapsulated, cyst-like structures, 40 to 300 μ in diameter and containing numbers of spherical endospores, of *Rhinosporidium seeberi* [*R.A.M.*, xviii, p. 29 and next abstracts]. This is only the seventh record of the fungus for North America and the first for the south-west of the United States.

Anant Narayan Rao (M.). **Rhinosporidiosis in bovines in the Madras Presidency, with a discussion on the probable modes of infection.**—*Indian J. vet. Sci.*, viii, pp. 187–198, 4 pl., 1938. [Abs. in *Bull. Inst. Pasteur*, xxxvii, 6, p. 374, 1939.]

In the Presidency of Madras the author has observed numerous cases of rhinosporidiosis in bovines and one in an equine [see next abstract]. The agent of the disease among bovines is probably the same as in man [*Rhinosporidium seeberi*: see preceding abstract], a detailed account of the life-history of which is given. The fungus probably occurs as a saprophyte in soil and infects both agricultural labourers (the chief sufferers from the disease) and oxen by means of the dust raised in field operations.

Sahai (L.). **Rhinosporidiosis in equines.**—*Indian J. vet. Sci.*, viii, pp. 221–223, 2 pl., 1938. [Abs. in *Bull. Inst. Pasteur*, xxxvii, 6, pp. 374–375, 1939.]

A description is given of the life-history of *Rhinosporidium equi*

[*R.A.M.*, xvi, p. 462], nearly allied to *R. seeberi* [see preceding abstracts], which was isolated in India from a cauliflower-shaped tumour in the nasal cavity of a horse.

JAKL (J.). **Dermatomykosen bei Hunden.** [Canine dermatomycoses.] *Zvěrolék. Obz., 1938*, p. 221, 1938. [Czech. Abs. in *Zbl. Bakt.*, Abt. 1 (Ref.), cxxxii, 21–22, pp. 485–486, 1939.]

Pathogenic fungi were detected in only ten of the 105 dogs (9·5 per cent.) examined in Czechoslovakia for suspected mycoses, *Achorion quinckeanum* being present in three, *Microsporon lanosum* [*R.A.M.*, xvii, p. 599; xviii, p. 393] in five, and *Trichophyton vinosum* [ibid., x, p. 106] in two cases. Inoculation experiments on guinea-pigs gave positive results with the two first-named organisms, while the outcome with *T. vinosum* was negative. No morphological or biological differences could be discerned between the canine cultures and those derived from human sources, and transmission from dogs to man and vice versa is therefore probable.

BOERS (E. R. J.), KOUWENAAR (W.), & WOLFF (J. W.). **Mycetoma pedis (Maduravoet).** [Mycetoma pedis (Madura foot).]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxviii, 27, pp. 1606–1613, 7 figs., 1938. [English summary.]

From the black grains of the mycetoma in a case of Madura foot [cf. *R.A.M.*, xviii, p. 310] in a 50-year-old Punjabi male, resident for 20 years in Sumatra, a species of *Madurella* presenting many analogies with *M. americana* [ibid., vi, p. 112] was isolated on various media, of which potato-glycerine and bouillon proved more suitable than Sabouraud's agar, room temperature being the optimum for growth. Glucose and maltose were utilized with slight acid formation; gelatine was not liquefied; litmus whey underwent no change. On potato-glycerine the abundant growth is chocolate-brown, dry, cerebriform, coarsely furcate, without aerial mycelium, and very tenacious. The irregular, septate hyphae, 2 to 2·5 μ in diameter, secrete a brownish-black pigment, and at an advanced stage sclerotia and chlamydospores, 10 to 13 μ in diameter, are formed. This is believed to be the first case of Madura foot actually contracted in the Dutch East Indies.

MILOCHEVITCH (S.). **Dermatophyties et lutte contre ces affections en Yougoslavie.** [Dermatophytoses and the control of these disorders in Yugoslavia.]—*Bull. Off. int. Hyg. publ.*, xxx, 10, pp. 2333–2341, 1938.

The microscopic and cultural examination of dermatological material submitted by the regional hygienic organizations affiliated to the Central Institute of Hygiene of Yugoslavia showed the exclusive agent of microsporosis to be *Microsporon audouini* [*R.A.M.*, xvii, p. 244] of purely human origin (the fungus has not yet been isolated from animals in the country). During a period of nearly eight years, 526 cases of trichophytosis, 169 of microsporosis, and 224 of favus have been recorded. Generally speaking, dermatomycosis is more prevalent in the east than in the west. Microsporosis has been observed only in Belgrade and the Voivodina, favus occurs chiefly in Serbia, Montenegro, Bosnia,

and Herzegovina, while the distribution of trichophytosis is more widespread. On the whole, *M. audouini* seems to be gradually making its way from the west eastwards, whereas *Trichophyton violaceum* [loc. cit.] is slowly proceeding from eastern to western Europe. The last-named organism is the principal cause of trichophytosis, followed by *T. album* [loc. cit.], *Ctenomyces* [*T.*] *mentagrophytes*, *C. radiolatus* [*T. radiolatum*] [ibid., xvii, p. 680], *T. glabrum*, *T. immergens* [ibid., xvii, p. 818], *T. langeroni* [ibid., xiii, p. 577], *C. bossae* [ibid., xv, p. 297], and other species. *Achorion schoenleini* is the pathogen of favus, the symptoms of which may also be induced, however, by *T. album* [ibid., xv, p. 580] and *T. immergens*.

De Busscher (J.), Scherer (H. J.), & Thomas (F.). **La méningite à Torula.** [Meningitis due to *Torula*.]—*Rev. neurol.*, lxx, 2, pp. 149–168, 9 figs., 1938.

After summarizing Freeman's monograph (*J. Psych. Neurol.*, xliii, p. 236, 1931) of 43 observations on meningo-encephalitis caused by *Torula histolytica* [*Debaryomyces neoformans*: *R.A.M.*, xviii, p. 396], the writers describe at length and fully discuss a fatal case of the disease in a 28-year-old female factory worker in Belgium.

Quodbach (K.). **Ein Beitrag zur Pathologie der Blastomykose des Zentralnervensystems.** [A contribution to the pathology of blastomycosis of the central nervous system.]—*Zbl. allg. Path. path. Anat.*, lxix, 7, pp. 227–231, 3 figs., 1938.

Clinical details are given of a fatal case of blastomycosis (*Torula histolytica*) [*Debaryomyces neoformans*: see preceding and next abstracts] in a 37-year-old man at Rostock, Germany. The varying aspects of the organism appeared to be conditioned by its localization in different sites rather than by any fundamental instability. Attention is drawn to the very low degree of pathogenicity exercised by *D. neoformans* independently, the lethal outcome of blastomycosis (in Germany) being invariably preceded by some chronic disease—rheumatic pancarditis in the case under discussion.

Greenfield (J. G.), Martin (J. P.), & Moore (M. T.). **Meningo-encephalitis due to Cryptococcus meningitidis (Torula histolytica) with report of a case.**—*Lancet*, ccxxxv, 6012, pp. 1154–1157, 5 figs., 1938.

Full clinical details are given of a fatal case of meningo-encephalitis (for the causal organism of which the name *Cryptococcus meningitidis* is preferred to *Torula histolytica* [*Debaryomyces neoformans*: see preceding abstracts]) in an 18-year-old youth in London. The fungus is thought to have possibly gained entry through the broken skin of an injured finger.

Howell (A.). **Studies on Histoplasma capsulatum and similar form species. I. Morphology and development.**—*Mycologia*, xxxi, 2, pp. 191–216, 5 figs., 1939.

With the view of establishing the systematic position of *Histoplasma capsulatum* [*R.A.M.*, xvii, p. 816], causing histoplasmosis in man, a

comparative study was conducted with cultures of the fungus and of *Sepedonium chrysospermum*, *S. xylogenum*, *Chlamydomyces palmarum*, *Stephanoma tetracoccum*, and *Mycogone perniciosa* [ibid., xvii, p. 378]. The two genera *Histoplasma* and *Sepedonium* [ibid., xiv, pp. 234, 760] are both shown to form spores as bulbous enlargements of the terminal ends of terminal or lateral branches, but the former not only produces yeast-like bodies in its parasitic phase but also lacks phialospores during its saprophytic phase. The so-called asci of *Histoplasma* [ibid., xiv, p. 583] are shown to be aleuriospores and the 'ascospores' are merely fatty globules which stain readily and may be made to disappear by suitable reagents or by heating. It is suggested, therefore, that *Histoplasma* should at present be considered a separate genus in the Fungi Imperfecti.

KREUTZFELDT-PLATHE (R.). **Ueber den Stoffwechsel von Penicillium thomii Maire.** [On the metabolism of *Penicillium thomii* Maire.]—*Vorratspflege u. LebensmittForsch.*, ii, 2, pp. 87–120, 6 figs., 2 diags., 13 graphs, 1939.

Penicillium thomii [*R.A.M.*, xv, p. 183] having been found, in the course of intensive studies now proceeding at the Prussian Dairy Experiment and Research Station (Kiel), severely to impair the quality of stored butter, a comprehensive investigation on the metabolism of the mould was conducted under strictly controlled conditions and is here fully described and tabulated.

KOCHMAN (J.). **Choroby Lwiej Paszczy (Antirrhinum majus): rdza, Puccinia antirrhini Diet. et Holw. i plamistość liści, Phyllosticta antirrhini Syd.** [Diseases of Snapdragon (*Antirrhinum majus*): rust, *Puccinia antirrhini* Diet. & Holw. and leaf blight, *Phyllosticta antirrhini* Syd.]—*C.R. Soc. Sci. Varsovie*, xxxi, 4, pp. 136–159, 1 fig., 2 pl., 1938. [English summary. Received May, 1939.]

Rust (*Puccinia antirrhini*) of snapdragon (*Antirrhinum majus*) [*R.A.M.*, xviii, p. 413] was observed for the first time in Poland by Wróblewski in 1936. In experiments conducted by the author in Warsaw a larger number of uredospores germinated at 10° C. than at 18°, but whereas at 10° the germ-tubes began to appear after four hours, at 18° they appeared after two. The germ-tubes attained a length of 50 μ after five hours at 10° and of 150 μ at 18°. In the field, about 0·3 per cent. of the uredospores germinated in the spring after overwintering, the lowest temperature recorded during the winter being —24°. Artificial inoculation with uredospores was invariably successful after 10 to 12 days, while teleutospores failed to produce infection. The germination of uredospores of *P. antirrhini* was arrested, at a temperature of 16° to 18°, by 0·01 per cent. solutions of either lime-sulphur or colloidal sulphur, while much stronger concentrations of copper sprays were needed to achieve the same effect. Hybrids between the native susceptible varieties, All Gold, Rubin, Othello, and Kermesinum splendens, and a resistant American variety all showed complete resistance in the first generation and were of high commercial value. Spraying with colloidal sulphur (0·7 per cent.) or lime-sulphur (1 in 60) three times at ten-day intervals considerably reduced the amount of infection, while 1 per cent. Bordeaux mixture proved ineffective.

Phyllosticta antirrhini [ibid., xv, p. 559] is recorded for the first time in Poland on snapdragon plants in the glasshouse and in field plots in Warsaw.

Van Hell (W. F.). **Bladgrond en de Sclerotium ziekte.** [Leaf base and the *Sclerotium* disease.]—*Orchidee*, viii, 2, pp. 32–34, 1939.

Orchids of the genus *Paphiopedilum* are reported to have been attacked in Java by *Sclerotium rolfsii* [*R.A.M.*, xvii, p. 750], which invades the plants from the soil through the root-collar and under humid conditions rapidly extends to the leaves and destroys them. The sclerotia of the fungus have been experimentally shown to retain their viability for four years. Good control has been secured by immersion of the diseased plants (after careful removal of the sclerotia) in a 1 per cent. solution of copper sulphate and sterilization of the pots and soil by heat (15 minutes at 60° C.). The infected debris should also be immersed for 24 hours in a copper sulphate solution at 1 per cent. or stronger.

Matsumoto (T.) & Hirane (S.). **Two strains of Petunia mosaic.**—*Trans. nat. Hist. Soc. Formosa*, xxix, 184–185, pp. 1–12, 3 figs., 1939.

Two strains of *Petunia* mosaic virus [*R.A.M.*, vi, p. 431; cf. ibid., xvii, p. 600] are stated to occur in Taihoku, Formosa, Japan, one of which (A) produces more conspicuous vein-clearing in the incipient stage of the disease than (B), accompanied by chlorosis of the mesophyll tissues along the veins. The virulence of strain (A) is markedly less than that of (B), the incidence of infection in inoculation experiments being under 20 per cent. even at a concentration of 1 in 50 (unfiltered juice) and nil at 1 in 100. The infectivity of this strain is further much reduced by passage through a Berkefeld filter (N). Both strains are capable of attacking tomato, tobacco, *Nicotiana affinis* [*N. alata*], and *N. sanderae* in addition to their natural host, but their effects on *N. sanderae* are quite distinct, being characterized in the case of (B) by severe necrosis in place of a relatively mild foliar mottling. Strain (B) is very closely related serologically to the virus of ordinary tobacco mosaic, with which, in fact, it appears to be identical, whereas (A) reacts quite differently, being unable to produce antibodies to any appreciable extent and failing to respond to the antisera prepared from (B) or the tobacco mosaic virus. The leaf tissues of *Petunia* and tobacco plants infected by strain (B) contain the vacuolate bodies and plate-like crystals associated with tobacco mosaic, which have in no case been found in foliage attacked by (A). Cytological studies therefore give useful data for the differentiation of the two *Petunia* mosaic strains.

Di Micheli (G.). **L'oidio delle Ortensie in Italia.** [Hydrangea mildew in Italy.]—*Ann. Fac. agr. for. Firenze, 1937–8*, Ser. III, i, pp. 237–248, 3 pl., 1938. [Received March, 1939.]

In this paper the author gives a semi-popular account, with numerous references to the relevant literature, of the geographical distribution, symptoms, morphology, and control of hydrangea mildew (*Microsphaera polonica*) [*R.A.M.*, xvi, p. 679]. The disease was first observed in Italy

in 1932 in a glasshouse in Florence, and since then it has been seen in Piedmont and two other districts of Florence.

TOMPKINS (C. M.). **Two mosaic diseases of annual Stock.**—*J. agric. Res.*, lviii, 1, pp. 63–77, 7 figs., 1939.

An account is given of comparative studies of two virus diseases of annual stock (*Matthiola incana* var. *annua*) in California, the first of which, termed mild mosaic, was briefly described by the author in 1934 [*R.A.M.*, xiv, p. 172]; the second, severe mosaic, was first found in 1935 near San Pablo. Both diseases are chiefly characterized by flower 'breaking' and leaf mottling, the symptoms being more conspicuous in severe mosaic, and cause considerable losses to cut flower and seed crops in the cool coastal valleys of California. In nature both are transmitted by the turnip or false cabbage aphid (*Lipaphis pseudobrassicae*), and are also readily transmissible by juice inoculation into the leaves with carborundum; tests for transmission through the seed gave negative results. All self-coloured varieties of annual stock are highly susceptible to infection with both diseases, as indicated by leaf mottling and flower 'breaking'; leaf mottling was induced by inoculation in varieties with white or yellow flowers, but not 'breaking'. Both viruses were experimentally shown to infect, *inter alia*, turnip, black mustard, white mustard, dames violet (*Hesperis matronalis*), evening scented stock (*M. bicornis*), and Turkish and White Burley tobacco. On the other hand, Chinese mustard (*Brassica juncea*), pe-tsai (*B. pe-tsai*), radish, Virginian stock (*Malcomia maritima*), wallflower (*Cheiranthus cheiri*), and a number of other plants were only susceptible to the mild mosaic, whereas *Chenopodium album*, spinach, and *Petunia* were only infected by the severe mosaic; the fact that neither was infective to cabbage, cauliflower, kale, Brussels sprouts, sprouting broccoli, kohlrabi, rape, or rutabaga serves to differentiate them from certain other viruses of crucifers. Flower 'breaking' of annual stock may also be induced by the viruses of Chinese cabbage, turnip [ibid., xviii, p. 223], horse-radish, and cabbage mosaics, and that of cabbage black ring [ibid., xvii, p. 152].

Technical descriptions are given of the two viruses. The mild mosaic virus remained infectious for five days after storage at 22° C., and supported 1 in 4,000 dilution, whereas the severe mosaic retained infectivity for seven days and at dilutions up to 1 in 3,000. The inactivation temperature for each virus was between 58° and 60°.

MACDONALD (J. A.). **Powdery mildew on Cinerarias.**—*Gdnrs' Chron.*, cv, 2721, p. 111, 1 fig., 1939.

A note is given on an outbreak, believed to be the first recorded for Scotland, of powdery mildew (*Oidium* sp.) [? *Erysiphe cichoracearum*] on cinerarias [*R.A.M.*, ix, p. 595] at St. Andrews. Of 18 plants grown in the same greenhouse, the 12 of the Grandiflora strain were all attacked, while only one of the six Stellata contracted infection, which was confined to the stem. The seed of all the plants was obtained direct from an English firm, and it thus appears probable that the fungus is capable of infecting the developing fruits during the flowering period and surviving on them until the occurrence of germination in the following season.

KOTTHOFF [P.]. **Eine neue Pilzkrankheit an Edelginster.** [A new fungous disease of *Cytisus hybridus*.]—*Kranke Pflanze*, xvi, 2, pp. 24–26, 2 figs., 1939.

Ceratophorum setosum [*R.A.M.*, xviii, p. 116] has recently been isolated in Westphalia from *Sarothamnus* [*Cytisus*] *scoparius* [ibid., xvii, p. 686], largely used as a green manure and for the protection of young stands in forest nurseries, as well as from *C. hybridus*, on which the fungus is reported to cause heavy damage. Inoculation experiments with the mycelium from pure cultures (which made good growth on standard agar media and potato slices, but sporulated profusely only on the natural substratum) gave positive results on unwounded leaves of *C. laburnum* and yellow lupin (*Lupinus luteus*), while a potted *C. scoparius* plant was killed within a fortnight. The destruction of diseased material and repeated applications of 2 per cent. Bordeaux mixture are recommended.

STEYN (D. G.). **Fungus-infected and fermented feeds dangerous to stock.**—*Fmg S. Afr.*, xiv, 155, p. 69, 1939.

Details are given of recent cases of poisoning in live stock due to the consumption of fungus-infected feeds, symptoms of paralysis being induced by *Diplodia zeae* on maize cobs and stalks; hypersensitiveness, partial paralysis, respiratory trouble, and muscular spasms by *Claviceps* [*paspali*] on *Paspalum* [*dilatatum*: *R.A.M.*, xvii, p. 299]; and arthritis and visceral gout (in geese) by *Penicillium glaucum* on maize.

HINDMARSH (W. L.) & HART (L.). **Poisoning of cattle by ergotized Paspalum.**—*Vet. Res. Rep. N.S.W.*, *1937*, 7, pp. 78–88, 1938. [Abs. in *Chem. Abstr.*, xxxiii, 9, p. 3423, 1939.]

The toxicity of the *Paspalum* [*dilatatum*] ergot fungus [*Claviceps paspali*] to cattle, sheep, and horses [see preceding abstract] in New South Wales [*R.A.M.*, xvii, p. 326] appeared to reach a climax during the development of the sclerotia. Mature sclerotia were less toxic than the grass infested by the fungus at the time of ergot formation.

PESANTE (A.). **Prime ricerche sulla sistematica e sulla biologia delle 'Stromatineae' parassite dei fruttiferi in Italia.** [First researches on the systematic position and biology of the 'Stromatineae', parasites of fruit trees in Italy.]—*Ann. Fac. agr. for. Firenze*, *1937–8*, Ser. III, i, pp. 395–424, 9 pl., 7 figs., 1938. [Received March, 1939.]

This is an expanded account of work on *Stromatinia* [*Sclerotinia*] already noticed from another source [*R.A.M.*, xv, p. 233].

Mould in cool stores. Its cause, types, and prevention.—*Fruit World, Melbourne*, xl, 1, pp. 23–24, 1939.

This is a report of the address delivered by T. O. Mitchell to The Orchardists' and Fruit Cool Stores Association of Victoria, dealing with the practical aspects of the prevention of moulds (mainly *Penicillium* and *Aspergillus* spp.) in cool stores [*R.A.M.*, xvii, p. 614], where they are a constant source of infection to foodstuffs. The presence of moulds may be reduced to a negligible minimum by good sanitation, accurate adjustment of temperatures, avoiding those at which germination and growth of moulds can thrive, and finally by the use of antiseptics.

Shirlan AG and shirlan WS proved in New Zealand trials to be very effective in controlling moulds. Shirlan AG may be added to water-paints or used as a spray with water at the rate of 1 lb. in 30 gals. Shirlan WS is used at strengths of 0·01 to 0·1 per cent. solution for washing down walls or added to lime-wash paints or distempers. Sterilizing of cases at the beginning of the packing season by dipping in a hot or boiling solution of shirlan WS (1 lb. in 10 to 20 gals. water) not only destroys all the spores present in the cases but also prevents a subsequent invasion over a protracted period.

CHARLES (VERA K.). **A note on the occurrence of Marasmius pyrinus.**—*Mycologia*, xxxi, 2, pp. 228–230, 1 fig., 1939.

Marasmius pyrinus is recorded on the fruit of apple [*R.A.M.*, xvii, p. 737], collected by A. B. Groves at Winchester, Virginia, where it has been observed several times before, apparently always following arsenical spray injury.

MOORE (M. H.), STEER (W.), & SHAW (H.). **Recent work on fungicides and insecticides at East Malling.**—*Sci. Hort.*, vii, pp. 85–95, 1939.

Bordeaux mixture and other copper preparations caused injury to apple trees at East Malling even when used at such a low concentration that they were no longer satisfactory as fungicides. The spray programme recommended against apple scab [*Venturia inaequalis*: *R.A.M.*, xvii, p. 689] is 2½ per cent. lime-sulphur at green- and pink-bud, 1 per cent. at petal fall, and ¾ per cent. afterwards, as necessary, at fortnightly intervals; 0·5 per cent. colloidal sulphur may be used instead of lime-sulphur for post petal-fall applications. A zinc-lime mixture and tetramethylthiuram disulphide [loc. cit.] have both shown promise in the field and are to be further tested; the latter is about ten times as toxic to the spores of *V. inaequalis* as is the monosulphide.

The spray programme recommended against pear scab [*V. pirina*] is lime-sulphur (2½ per cent.) shortly after bud burst, and again at white bud, and Bordeaux mixture (4–6–100) with cottonseed oil (3 qts. per 100 gals.) at petal fall and again two or three weeks later.

Excellent control of brown rot of Morello cherries [*Sclerotinia laxa*] results from cutting out the infections in spring, and giving one application of tar oil (10 per cent.) late in January, and one of Bordeaux mixture (6–9–100) just before blossoming. With standard plums and sweet cherries, on which the removal of infections is not practicable, spraying should be resorted to when infection warrants it. The incidence of bacterial canker [*Pseudomonas mors-prunorum*: ibid., xvii, p. 693] on the susceptible Bigarreau de Schrecken cherry variety has for some years been greatly reduced by spraying with Bordeaux mixture once in autumn at a concentration of 10–15–100 and once in spring at one of 6–9–100.

Apple branch blister, formerly attributed to *Coniothecium chomatosporum* [ibid., xvii, p. 45], has been ascertained to be of physiological origin and associated with lack of moisture and available potash, and possibly other factors. It is most prevalent on Cox's Orange Pippin on No. 11 rootstock, especially on light, arid soils.

[This paper is reprinted in *Rep. E. Malling Res. Sta., 1938*, pp. 253–261, 1939.]

Holz (W.). **Eine Methode zur Prognose des Askosporenfluges von Fusicladium dendriticum (Wallr.) Fckl. (Vorläufige Mitteilung).** [A method for the prognosis of the ascospore flight of *Fusicladium dendriticum* (Wallr.) Fckl. (Preliminary note).]—*NachrBl. dtsch. PflSchDienst*, xix, 2, pp. 12–13, 1 graph, 1939.

A simple method has been devised at the Stade [North Germany] branch of the Biological Institute for the prognostication of the inception of ascospore discharge in the apple scab fungus (*Fusicladium dendriticum*) [*Venturia inaequalis*: *R.A.M.*, xvii, p. 464; xviii, p. 37]. Beginning in the middle of March, 1938, Boskoop leaves, overwintered in the open, were brought daily to the laboratory about 8 a.m., well moistened, and laid in a dish lined with damp blotting paper. To trap the liberated acospores three greased slides were laid on the leaves and left in the closed dishes for two hours, whereupon they were dried in the air and microscopically examined for acospores. By similar means the ascospores produced on foliage of the same variety, collected in flower pots and left out-of-doors, were caught, and the laboratory and garden results compared from time to time. The first ascospores were trapped in the laboratory on 16th March and in the open on the 24th, following rain. An immediate notification of the laboratory results would thus enable growers to utilize the interval regularly elapsing between indoor and outdoor ascospore production for the application of the first, and by common consent most important, fungicidal treatment. It is suggested that the method may be widely employed (naturally with due allowance for variations in climatic conditions) by plant protection stations, horticultural institutes, and the like.

Maier (W.). **Die fungizid wirksamen Kupfermengen bei der Blauspritzung der Obstbäume.** [The fungicidally active quantities of copper in the 'blue' spraying of fruit trees.]—*Z. PflKrankh.*, xlix, 3, pp. 160–176, 3 graphs, 1939.

A detailed, tabulated account is given of the writer's experimental observations in 1937 at the Geisenheim (Rhine) Research Institute on the fungicidally active quantities of copper in the rain water from nine pear trees—three standards (Stuttgart Gaishirtle, Giffard's Butter, and Summer Egg), three spindle pyramids (Holzfarbige Butter, Diel's Butter, and Hardenpont's Winter Butter), and three fan-trained (Esperens Bergamotte, Diel's Butter, and Hardenpont's Winter Butter)—treated against scab (*Venturia pirina*) by the so-called 'blue' spray (6 per cent. Bordeaux mixture) [*R.A.M.*, xvi, p. 542 *et passim*]. The standards received only one (dormant) application on 23rd March, while the two other groups were given a second treatment with 1 per cent. Bordeaux on 24th May. The copper determinations were made by Schachkeldjan's method (*Z. analyt. Chem.*, lxxxi, pp. 139–140, 1930), based on the colorimetric measurement of the raspberry colour produced in an ammonium-containing copper solution by the admixture of sodium salicylate with acetate of benzidine solution and calcium cyanide.

The amounts of copper detected in the rain water declined steadily from the first analysis on 21st April, when an average of 4·8 γ per c.c. ($1\ \gamma = 0{\cdot}001$ mg.) was calculated, to the last on 13th August (0·4 γ), though even by October the reserves were not completely exhausted,

as shown by the presence of traces of copper in the test-tubes on the 4th. The copper was washed off the fan-trained and pyramid trees much more rapidly than in the case of the standards. The minimum copper concentration found to arrest conidial germination and germ-tube extension in precipitation water from pear leaves was 1·2 γ per c.c., which in 17 hours at a temperature of about 20° C. after evaporation reduced the number of germinating conidia from 41·4 to 19 per cent. and the length of the germ-tubes from 123·1 to 83·2 μ. There is reason to believe, however, that smaller amounts would produce comparable results in nature.

The fundamental differences between the 'blue' method, applied in the dormant stage, and the standard Bordeaux schedule, including treatment of the trees in leaf, are discussed in relation to their practical significance. From the data obtained in the present trials the 'blue' spray would seem to confer adequate protection against infection before and during blossoming, but not against late scab, which will almost invariably require a special separate treatment. The 'blue' spray should be applied as late as possible in view of the liability of the copper deposits to washing off by spring rains. By periodical determinations of the copper content of the rain water from sprayed trees it may be possible to establish the critical date for the application of further treatments.

KIENHOLZ (J[ESS] R.). **Stony pit, a transmissible disease of Pears.**—*Phytopathology*, xxix, 3, pp. 260–267, 2 figs., 1939.

'Stony pit', a virus disease of pears, causes the development of gnarled or pitted fruit, the tissue at the base of the pits generally becoming necrotic and producing numerous sclerenchyma cells. On the Bosc variety fruit pitting is accompanied by a 'measled' condition of the bark, which at an advanced stage of the disorder resembles that of a mature oak. The cortical symptoms on the stock may precede those on the scion by several years, or vice versa. A faint mottling or the formation of chlorotic areas along the leaf veinlets also appears to be associated with 'stony pit', which did not yield to experimental treatments with zinc, copper, boron, or manganese. The disease, which causes losses of 10 to 80 per cent., was easily transmitted by infected Bosc buds to healthy Bosc and Anjou trees, the symptoms generally appearing in the second season after inoculation. Bartlett was shown by the same method to be tolerant or immune. 'Stony pit' is known to have been present in Oregon for many years and also occurs in California and Washington.

YARWOOD (C. E.). **Powdery mildews of Peach and Rose.**—*Phytopathology*, xxix, 3, pp. 282–284, 1 fig., 1939.

Powdery mildews (*Sphaerotheca pannosa*) of peach and rose [*R.A.M.*, xvii, p. 693; cf. also ibid., xviii, p. 120] are stated to cause considerable damage in California. The former overwinters in part in diseased peach buds, which show systemic infection on emergence in the spring. In a test at Berkeley, 17 mildewed and 112 healthy leaf shoots had developed on 18th February, 1936, from 57 dormant twigs surface-sterilized and placed in plugged tubes on the previous 28th January.

The mildew makes slow progress on the leaves in the spring, but up to 97 per cent. infection was observed on walnut-sized fruits on 31st May, 1938. Circumstantial evidence only is forthcoming for the overwintering of *S. pannosa* in rose leaves and buds. Attempts to infect roses with the peach strain of *S. pannosa* resulted only in mycelial growth on detached leaflets of Briarcliff, Belle of Portugal, and Pernet in 10 per cent. sucrose solution, while the conidia of the rose strain merely penetrated the peach leaf cells without proceeding further. Moreover, the average dimensions of 90 rose leaf conidia were 27·4 by 14·2 μ compared with 23·4 by 13·4 μ for the same number from peach foliage. Ornamental peach leaves suffering from curl (*Taphrina deformans*) have been found to contract mildew much more readily than healthy ones.

STRAŇÁK (F.) & BLATTNÝ (C.). **Důležití a významní škodliví činitelé kulturních rostlin v Čechách ve vegetační sezoně 1937–1938.**—[Important and significant pests and diseases of cultivated plants in Czechoslovakia during the vegetative season 1937–1938.]—*Ochr. Rost.*, xv, 2, pp. 3–11, 1939. [German summary.]

In this report [cf. *R.A.M.*, xvii, p. 500] *Phyllosticta mali* [ibid., xvi, p. 564] is stated to have been frequently observed on apples, and *P.* [*Phoma*] *prunicola* [ibid., xvi, p. 106] widespread on plums. Mosaic diseases of peach and other *Prunus* spp. have been almost entirely eliminated from nurseries. Several isolated cases of vine mosaic [ibid., xvi, p. 299] are reported from some vineyards near Mělník.

ROGERS (W. S.), KING (MARY E.), & MASSEE (A. M.). **Results of researches on Strawberry growing.**—*Sci. Hort.*, vii, pp. 71–84, 3 pl., 2 figs., 1939.

Further work at East Malling has shown that strawberry xanthosis in California and yellow edge in England are probably identical [*R.A.M.*, xvi, p. 762; xviii, pp. 326, 402]. The symptoms of yellow edge on Royal Sovereign become masked at certain seasons and develop at other times, while the symptoms on other varieties also vary. Even the so-called 'symptomless carriers' show signs of infection at certain seasons, and may deteriorate as much as the Royal Sovereign variety. The susceptible varieties, Little Scarlet, Deutsch Evern, Royal Sovereign, The Duke, Sir Joseph Paxton, Stirling Castle, and Pillnitz should not be grown with varieties of 'intermediate' or 'carrier' groups, the former consisting of Axbridge Early, Madame Kooi, Laxton, Western Queen, Scarlet Queen, Early Cambridge (Boyes' Seedling), Jucunda, and Tardive de Léopold, and the latter of Madame Lefebvre, Oberschlesien, Huxley, Bedford Champion, and Super.

Mild crinkle [ibid., xvii, p. 694; xviii, p. 402] is certainly widely distributed through existing strawberry stocks, but it causes scarcely any damage. It need not be rogued from runner beds. Severe crinkle [loc. cit.], on the other hand, must be eliminated, though the exact stage at which the disease becomes serious is difficult to define, as the intermediate symptoms between severe and mild crinkle might belong to either. Plants showing intermediate symptoms should be rogued out as soon as definite signs of severe crinkle appear. On *Fragaria vesca* crinkle produces small blisters on the leaves, accompanied by chlorotic

speckling and curling. Plants affected with yellow edge may also be infected with crinkle, though the latter condition may often not be apparent. [This paper is reprinted in *Rep. E. Malling Res. Sta., 1938*, pp. 223–234, 3 pl., 2 figs., 1939.]

CARTER (W.). **Geographical distribution of yellow spot of Pineapples.**—*Phytopathology*, xxix, 3, pp. 285–287, 1 fig., 1939.

Both the widely cultivated Queen pineapple and the scattered plantings of Cayenne in the Bathurst district of South Africa were observed in November, 1937, to be affected by a disorder externally indistinguishable from the yellow spot of Hawaii [*R.A.M.*, xvii, p. 828]. The relatively high incidence of fruit symptoms (necessitating the rejection of 10 per cent. prior to shipment to the fresh fruit market in one instance) and the very slight involvement of the leaves and crowns point to a flower-feeding insect as the vector of the disease. In this connexion mention is made of the detection of *Frankliniella schultzei*, an important carrier of 'kromnek' [ibid., xvii, p. 442], in the pineapple flowers, and of 'kromnek'-diseased weeds in the pineapple plantations. Dr. E[nid] S. Moore is stated recently to have obtained evidence of the identity of 'kromnek' with tomato spotted wilt.

A visit to the Philippine Islands in May, 1938, failed to reveal any evidence of yellow spot either on pineapple or the species of *Emilia* serving as a local weed host, while *Thrips tabaci*, the supposed insect vector, was also missing. The symptoms reported by Serrano as caused by yellow spot [ibid., xv, p. 378] are attributed by the author to a hitherto undescribed disease of an entirely different character.

YARWOOD (C. E.). **Control of powdery mildews with a water spray.**—*Phytopathology*, xxix, 3, pp. 288–290, 1939.

The known deleterious action of rain on certain powdery mildews [*R.A.M.*, xvi, p. 105] suggested the possibility of combating diseases of this group by means of a water spray. Water at about 70 lb. pressure was applied in the late afternoon at appropriate intervals for varying periods with sufficient force to obtain a washing effect for a few seconds in each treatment. The following results were obtained. The percentages of leaves infected by *Oidium euonymi-japonici* on *Euonymus japonicus* [ibid., xii, p. 578] and by *Sphaerotheca pannosa* on Dorothy Perkins rose [see above, p. 463] were reduced from 78 to 33 and from 72 to 21, respectively; in the cases of *Erysiphe cichoracearum* on two plants of cucumber [ibid., xvii, p. 585] (sprayed 3 and 6 days after inoculation), *E. polygoni* on four Pinto beans [*Phaseolus vulgaris*: ibid., xvi, pp. 104, 363] (daily for 11 days), and *E. graminis* on 75 plants of barley [ibid., xvi, p. 104; xvii, p. 807] (9 and 11 days after inoculation), the numbers of mildew colonies were reduced from 615 to 0, 1,600 to 20, and 1,228 to 42, respectively. Care must be taken to avoid water-soaking of the leaves in beans and cucumbers.

HORSFALL (J. G.) & HARRISON (A. L.). **Effect of Bordeaux mixture and its various elements on transpiration.**—*J. agric. Res.*, lviii, 6, pp. 423–443, 1 fig., 3 graphs, 1939.

The effect of Bordeaux mixture on the transpiration [*R.A.M.*, xviii, p. 352] was studied on tomatoes and beans (*Phaseolus vulgaris*) in the

greenhouse in winter. High temperature during the application of the spray was found to increase the rate of transpiration, while the temperature on succeeding days had little effect. The transpiration was increased by both the alkaline (hydrated lime alone) and the acid (Bancroft clay alone) materials tested. It was also increased by an improvement in the coverage and the filming qualities of Bordeaux. Desiccation of cut shoots and injury to transplants increased with spray load irrespective of the copper and lime contents of the spray, while the transpiration of potted plants rose with the spray load only to a point of about two parts of lime to one part of copper and then decreased sharply. Cottonseed oil emulsion alone or in combination with red cuprous oxide reduced the transpiration rate below that of unsprayed leaves. Bordeaux reduced the cuticular resistance to water loss and apparently clogged the stomata. On the basis of these results and facts available in the literature the following tentative hypothesis to account for the Bordeaux-induced transpirations is proposed: the alkalinity induced by Bordeaux mixture saponifies the cuticle and decreases its resistance to water loss (the acid spray achieving the same result by oxidizing the cuticle), but on the other hand it may clog some stomata, and is further apt to cool the leaf in bright weather; the balance between these factors will determine the increase in transpiration. It is suggested that in the field cuticles may be so thick and hard as to resist saponification and then the factors for reduced water loss may predominate.

NIEMEYER (L.). **Fortlaufend arbeitendes Kurznassbeizgerät 'Neusaat-Automatik' System Dipl.-Ing. Ott der Fa. F. Neuhaus G.m.b.H., Eberswalde.** [A continuously working short disinfection steeping apparatus 'Neusaat-Automatic' on the system of Dipl.-Ing. Ott of the firm of F. Neuhaus, Ltd., Eberswalde.]—*Masch. u. Geräteprüf. Reichsnährst.* (Suppl. to *Tech. in d. Landw.*), iv, 2, p. 17, 1 fig., 1939.

In collaboration with S. Reeh, K. Ebertz, and A. Winkelmann the writer tested the 'Neusaat-Automatic' short disinfection steeping machine (F. Neuhaus, Eberswalde), which is provided with a contrivance for the automatic distribution of the fungicide over the seed-grain as it flows into the cylinder. Satisfactory results were obtained with the appliance, which treats 250 to 1,500 kg. seed-grain per hour and costs RM. 356.

BIRAGHI (A.). **Determinazione della presenza di fluoro nei tessuti vegetali colpiti da emanazioni gassose.** [Determination of the presence of fluorine in plant tissues injured by gaseous emanations.]—*Boll. Staz. Pat. veg. Roma*, N.S., xviii, 3, pp. 360–366, 1 pl., 1938 (issued 1939).

Microchemical tests on olive leaves injured by fluorine compounds [*R.A.M.*, xvi, p. 701] in the smoke emitted by glassworks in the vicinity of the trees showed that the injured areas gave an abundant precipitate of hexagonal crystals of sodium fluorosilicate on the addition of appropriate reagents. Crystals of the same material were also obtained from apparently healthy leaves on the same branches, while apparently normal leaves from olives 200 to 250 m. distant from the glassworks showed the presence of a few similar crystals. None was found,

however, in healthy leaves obtained from a locality remote from the fumes in question.

Setterstrom (C.) & Zimmerman (P. W.). **Factors influencing susceptibility of plants to sulphur dioxide injury. I.**—*Contr. Boyce Thompson Inst.*, x, 2, pp. 155–181, 1 fig., 1939.

In this paper the influence of various environmental factors on the susceptibility of plants to sulphur dioxide injury is reviewed and the data, supplemented by new results from 29 factorial experiments with buckwheat and lucerne, are summarized as follows. Plants are much more resistant to sulphur dioxide at 40° F. or below than at higher temperatures; susceptibility does not, however, vary appreciably between 65° and 105°. In general, an increase in relative humidity leads to a decrease of resistance to sulphur dioxide, although in the range above 40 per cent. saturation a difference of at least 20 per cent. is needed to cause a noticeable change in susceptibility. Plants grown in soil amply supplied with water after fumigation are more susceptible than those supplied with little water, and poor soil and heavy shading are other conditions favouring injury. Young plants are more resistant than older ones.

Craigie (J. H.). **Economic diseases of field crops in Manitoba.**—*Contr. Bot. Pl. Path., Dep. Agric., Ottawa*, 574, 37 pp., 20 figs., 2 maps, 1939.

This is a semi-popular survey of fungous, bacterial, and virus diseases of cereals, beans, peas, flax, maize, potato, and hay crops in Manitoba. Particular stress is laid on the economic importance of the diseases, and estimates of the losses entailed are given. Control methods are briefly discussed.

Nakata (K.) & Hino (I.). **New system of phytopathology.** Volume I.—ii+254 pp., 112 figs., Tokyo, Yôkendô, 1938. Yen 3·30. [Japanese. Received May, 1939.]

The first volume of the authors' new system of phytopathology (of which a further four are stated to be in course of preparation) falls into two parts, one introductory, dealing with general aspects of the subject, and the other tracing the history of phytopathology in foreign countries (from earliest times) and Japan, discussing phytopathological organizations, legislation, and the trend of phytopathology, and giving also a review of the literature and a bibliography.

Chistiakoff (F. M.) & Bocharova (Mme Z. Z.). Влияние низких температур на микроорганизмы. II. IV. Влияние низких температур на развитие плесневых грибков. [The influence of low temperatures on micro-organisms. II. IV. The influence of low temperatures on mould development.]—*Микробиол.* [*Microbiol.*], vii, 4, pp. 498–514; 7, pp. 838–842, 1 fig., 1 graph, 1938. [English summaries. Received April, 1939.]

A fully tabulated account is given of the writer's studies at the Moscow Refrigeration Research Institute on the influence of low temperatures on mould growth on stored foodstuffs, which showed that the minimum temperature for the development of the fungi concerned lies well below 0° C. Delay in the appearance of visible growth and in

conidial formation increased *pari passu* with a decline in temperature and reached a maximum just before the limit of total inhibition. The following were the most resistant to low temperatures: *Penicillium glaucum*, *Mucor* sp., *Botrytis cinerea*, *Cladosporium herbarum* (developing freely at —5°), *Chaetostylium fresenii* (from white sturgeon in a refrigerator), *Monilia nigra*, *Thamnidium elegans* [*R.A.M.*, xviii, p. 255], and *Fusarium culmorum*.

No mould growth was observed during a period of 19 months at —18° and —12°, and at —8° fungal development occurred only on isolated pieces of meat and fish contracting infection during storage. On beef wort agar visible growth of *C. fresenii* became apparent only after 13 months, the corresponding period for development on fresh beef being only eight months after inoculation and transference to the storage chamber. On the other hand, *T. elegans* failed to develop after a year on fresh beef, whereas on wort agar visible growth appeared on the 54th day.

SHEFFIELD (F[RANCES] M. L.). **Micrurgical studies on virus-infected plants.**—*Proc. roy. Soc.*, Ser. B, cxxvi, 845, pp. 529–538, 1 pl., 1939.

The results of the examination of cells of several Solanaceous plants, both virus-infected and healthy, by micromanipulative methods [*R.A.M.*, xiv, p. 799] are described. No differences in hydrogen-ion concentration were observed between healthy and diseased plants in any type of cell. The amorphous intracellular inclusions of aucuba mosaic of tomato disintegrated immediately on slight mechanical pressure on the outside of the cell or on puncturing with a very fine needle. The inclusions appeared to be almost unaffected by acids over a range of P_H from 7 to 2·2, although in the more acid solutions they withstood maltreatment better than in a neutral one. Their stability seemed to depend on the osmotic pressure: at 0·1 M the inclusions persisted, at 0·07 M they disintegrated gradually, and below 0·05 M very rapidly. It was impossible to isolate the striate material of tobacco and enation mosaics, as the slightest pressure on the outside of the cell or pricking caused the plate-like crystals to break down into needle-like fibres.

BLUNCK (H.). **Viruskrankheiten bei Pflanzen.** [Virus diseases of plants.]—*Z. PflKrankh.*, xlix, 3, pp. 177–222, 1939.

This is a comprehensive survey, supplemented by an eight-page bibliography, of outstanding recent contributions to the knowledge of virus diseases of plants, discussed under various aspects, such as the nature of the infective principles, symptomatology, modes of transmission, analogies with human and animal viruses, technical methods of examination, molecular dimensions and weights, chemical, serological, and pathogenic properties of the crystalline proteins resulting from ultracentrifugation, and the arguments for and against the conception of the viruses as living entities.

BUTLER (E. J.). **The occurrences and systematic position of the vesicular-arbuscular type of mycorrhizal fungi.**—*Trans. Brit. mycol. Soc.*, xii, 3–4, pp. 274–301, 1 pl., 3 figs., 1939.

This paper deals with the distribution and morphological characters of the vesicular-arbuscular or Phycomycetoid endophytes [*R.A.M.*,

xvii, p. 698] which commonly occur in cultivated and probably other soils, forming mycorrhizal associations in the roots of many flowering plants and cryptogams, including prothalli of liverworts and of some ferns. The regularity of their occurrence in some perennial plants and their incidental presence in some annual field crops are believed to be merely the result of the greater opportunity to persist indefinitely, by passing from the older to later developed roots, offered to the organism in perennial plants. The extramatrical mycelium of the fungus is described as consisting of usually stout, tortuous-angular hyphae marked by characteristic unilateral angular projections, the hyphae being at first hyaline and thin-walled, but frequently becoming honey-yellow and thick-walled later by internal deposition of material, being then rigid and rather brittle. Septa are irregular and usually sparse or even absent from considerable parts of the mycelium; when present they may separate segments of a hypha which persists and presumably helps to secure the vegetative propagation of the fungus. The entry of the fungus generally takes place through a cell of the epidermis of the young root behind the meristematic region or through a root hair, the hyphae usually passing down through one or two layers of cells and then either entering the intercellular spaces of the cortex or continuing within the cells, or both. The characteristic organs of these fungi, the vesicles and the arbuscular-sporangiolar apparatus, are regarded as being mainly concerned with the accumulation of fatty material (possibly with accessory nutrients) and its transference to the higher plant. The vesicles, when present, develop terminally, or are rarely intercalary, on the intramatrical mycelium, whether this is in or between the cells, and on the mycelium around the roots, and may be oval, pear-shaped, round, or irregular. Their distinguishing character is their open communication with the hypha on which they are borne. A basal septum is not normally formed. The wall of the vesicle is at first thin and colourless, but it thickens by the deposition of one or more layers on the inside, and then may turn pale yellow to brownish. The size of the vesicles is variable; the largest seen by Janse (1896) were 135 by 35 μ in *Schismatoglottis* and 100 by 27 μ in *Piddingtonia*, and the smallest were up to 20 by 20 μ in *Cotylanthera* and up to 30 μ in *Turpinia*. Although probably several allied species of fungi are involved in this type of mycorrhiza, it is not possible on the basis of present knowledge to distinguish them by any constant morphological feature such as the size or shape of the vesicles. The arbuscule-sporangiole apparatus develops wholly within the cells and is always produced, being often confined to the inner cortical layers. The arbuscule arises from any part of the main hyphae. The primary branch may be stout or fine or merely a short projection from the side of a coiled hypha; it usually divides within the cell and ends in a close brush of filaments not exceeding 0·5 μ in diameter, each bearing a sporangiole, a very thin-walled sac which soon looses its smooth contour and becomes lumpy or mammillate, and then undergoes some kind of change ending in its contents, largely of a fatty nature, becoming mingled with those of the host cell. Records of the presence of fungi of this type in fossils are briefly reviewed and their discovery in material from the glacial clays underlying peat bogs ('muskegs') near Edmonton, Alberta, described.

The author's attempts to grow these fungi have been confined to the external mycelium and vesicles, and though fine, hyaline, new hyphae were sometimes obtained, they did not grow extensively. The new growth was invariably obtained from the old thick-walled hyphae, either as a lateral outgrowth or from a broken end, and though several of these old hyphae were attached to mature vesicles, the vesicle itself was not observed to germinate. Considerable differences of opinion are stated to exist regarding the identity of this group of fungi. In the author's view, which supports Peyronel's, these endophytes probably belong to species of the Endogonaceae, which have often lost the power of forming the compound fructifications common to the family. In the characteristics of the hyphae and the 'chlamydospores' or vesicles, the Endogonaceae are stated to show more resemblances to the group under consideration than any other fungi known to the author. It is, however, admitted that, pending further details of Peyronel's work, the proof of these conclusions is not yet fully established. Dangeard's (1900) account and figures of *Rhizophagus populinus*, a new genus and species set up by him in 1896 to define the endophyte as it occurs in poplars, leave no room for doubt that he was dealing with a typical member of the group. *Rhizophagus* thus appears to be the first legitimate name given to the present-day endophytes of the vesicular-arbuscular type in their imperfect condition, and may most satisfactorily be regarded as an imperfect genus of the Endogonaceae with at present only the named species *R. populinus*, *R. theae* (Zimm.) n.comb. (syn. *Protomyces theae* Zimmermann), and *R. marattiacearum* (West) n.comb. (syn. *Stigeosporium marattiacearum* West) [ibid., v, p. 571].

MAGROU (J.). **Nouveaux essais de culture des champignons de mycorhizes.** [New cultural experiments with mycorrhizal fungi.]—*C. R. Acad. Sci., Paris*, ccviii, 12, pp. 923–925, 1 fig., 1939.

Continuing his experiments with the endophyte of *Arum maculatum* [*R.A.M.*, xv, p. 243 and cf. preceding abstract], the writer found that a more luxuriant development than that hitherto obtained, accompanied in some instances by incipient arbuscule formation, could be induced by the provision of aneurin (vitamin B_1), which was added to the soil extract either in the form of 3 per mille groundnut peptone or 10 per mille autolysate of beer yeast. The medium, adjusted to P_H 6·6, was further enriched by biotin [ibid., xviii, p. 336] (three drops of alcoholic solution of yolk of egg per 10 c.c.), a filtered extract of macerated *Arum* roots, and in some cases by a millionth part of indoleacetic acid. The endophyte developed in 46 out of 52 cultures in Van Tieghem cells made during May (88 per cent.). Analogous results were secured in preliminary tests with the mycorrhiza of *Scilla bifolia*, *Veratrum album*, and *Solanum dulcamara*.

MALAN (C. E.). **Ricerche sui tubercoli radicoli e sulle micorize delle Leguminose alpine.** [Researches on the root tubercles and mycorrhiza of Alpine legumes.]—*Ann. Bot., Roma*, xxi, 3, pp. 465–494, 1938. [Received March, 1939.]

A study is described on the mycorrhiza of wild leguminous plants growing in the Alps in beech forests (including, among others, *Vicia*

cracca, *V. sativa*, *V. sepium*, *Trifolium medium*, *T. repens*, *T. pratense*, and *Lotus corniculatus*), in forests of larch (*Larix decidua*) (chiefly *L. corniculatus* and *T.* spp.), in glades in both types of forest (in which the leguminous plants found were similar to those in the respective forests), and in pastures (including *Corylus*, *Alnus*, *Rhododendron*, and *Vaccinium* spp.). The results showed that in all the Leguminosae studied endotrophic mycorrhiza with hyphae of the Phycomycetoid type [see preceding abstracts] predominated. Only in Leguminosae from glades on argillaceous soil was the endophyte of the *Rhizoctonia* type also observed, invariably associated with the Phycomycete.

Mycorrhizal development was greatest in the roots of Leguminosae growing in the forests and on leguminous hosts growing among Ericaceae, though it was also abundant on legumes growing along the higher edges of pastures. In cells invaded by the mycelium starch appears only when the hyphae undergo digestion. During its most vigorous period, the mycorrhiza feeds mainly on carbohydrates, hydrolysing starch and preventing its condensation until the root tissue has become infected. Numerous observations showed that the mycorrhiza never come into contact with the nitrogen nodules or with parts of the root in close proximity to them.

SEMPIO (C.). **Influenza della luce e dell' oscurità sui principali periodi del parassitamento. Studio condotto su alcune malattie fungine di piante coltivate.** [The influence of light and darkness on the principal periods of parasitism. A study carried out on some fungal diseases of cultivated plants.]—*Riv. Pat. veg.*, xxix, 1–2, pp. 1–69, 8 pl., 7 graphs, 1939.

A detailed account is given of studies carried out to ascertain the effects of darkness upon certain fungal diseases of plants during each of the three main periods of infection [*R.A.M.*, xviii, p. 48], namely, one to three or four days from the moment of inoculation, from the third to the sixth or the fourth to the seventh, and from the seventh to the ninth or tenth day, the first period covering germination of the spores, penetration of the promycelium into the host, and the initiation of parasitism, the second, spread of the mycelium in the host tissues (the 'central' phase of parasitism), and the third the maturation of the mycelium and the development and release of the fruit bodies. The diseases studied were *Bremia lactucae* on lettuce, *Cystopus candidus* on red radish, *Erysiphe graminis* and *Puccinia triticina* on wheat, and *Uromyces appendiculatus* on Cinquantino giallo beans. The potted seedlings when 15 to 20 days old were sprinkled with an aqueous suspension of the spores of the fungi and then placed for two days under glass covers. In each experiment four pots were used, one being exposed to darkness for the first, second, or third period of infection and kept under normal environmental conditions the rest of the time, while the fourth or control pot remained under normal conditions of light throughout.

The results obtained showed that exposure to darkness during the first period of infection in general stimulated infection, which was markedly more intense than in the controls. Exposure to darkness during the second period of infection had a retarding effect, infection

in nearly all cases being about equal to that of the controls. Exposure to darkness during the third period generally gave much less severe infection than in the controls.

VANTERPOOL (T. C.). **Homothallism in Pythium.**—*Mycologia*, xxxi, 2, pp. 124–127, 1939.

A study of single zoospore cultures (developed from single zoospores located on the surface of an agar plate, after distribution of a zoospore suspension) of *Pythium arrhenomanes* [see above, p. 449], *P. butleri* [*R.A.M.*, xviii, p. 89], *P. myriotylum* [ibid., xvii, p. 294], *P. torulosum* [ibid., xvii, p. 736], *P. complectens* [ibid., xvii, p. 297], and *Phytophthora cactorum* [ibid., xviii, p. 129] showed all these species to be strictly homothallic (monoecious, hermaphroditic, self-fertile).

KÖHLER (E.). **Zur Differenzierung des A- und Y-Virus im Infektionsversuch.** [On the differentiation of the A- and Y-viruses in inoculation experiments.]—*Naturwissenschaften*, xxvii, 13, p. 215, 1939.

The ordinary tobacco test is stated to be very unreliable for the differentiation of weak strains of the potato virus Y and strong ones of A [*R.A.M.*, xvii, p. 834]. It has recently been ascertained that *Nicotiana glutinosa* is immune from A but highly susceptible to Y, so that the use of this plant facilitates the separation of the two viruses in inoculation experiments without risk of confusion, a matter of particular importance in connexion with plant-breeding operations.

HEINZE (K.). **Spritzversuche zur Abtötung von Kartoffelkraut als Abwehrmassnahme gegen Viruskrankheiten.** [Spraying experiments in the destruction of Potato tops as a means of defence against virus diseases.]—*Z. PflKrankh.*, xlix, 3, pp. 129–142, 3 figs., 1939.

In experiments on the control of potato virus diseases by the chemical destruction of foliage, the author found that the following sprays were very effective and also killed the aphids: a mixture of 2·5 per cent. each cresol and fruit tree carbolineum, one of cresol and Baumspritzmittel of the same strength, and 3 to 10 per cent. sodium chlorate with 0·1 per cent. nicotine and a spreader. [An account of this work also appears in *NachrBl. dtsch. PflSchDienst*, xviii, 12, pp. 103–105, 1 fig., 1938.]

ROZENDAAL (A.). **Enkele opmerkingen over een virusziekte bij de Aardappelvariëteit Eersteling, en het verband met de stippelstreekziekte.** [Some observations on a virus disease of the Duke of York Potato variety and its relation to stipple streak disease.]—*Landbouwk. Tijdschr., Wageningen*, l, 619, pp. 1063–1088, 15 figs., 1938. [English summary. Received May, 1939.]

A severe mosaic of Duke of York potatoes, characterized in the primary phase by mottling and extensive crinkling of the uppermost leaves and fine, brown necroses along the veins on the under side, and in the secondary by small, necrotic spots on the petioles and main stem, has been observed of recent years in certain parts of Holland. The necrotic appearance of the foliage imparts a faint resemblance to stipple streak [*R.A.M.*, xvii, p. 126; xviii, p. 337], but careful examination

reveals well-defined differences in the configuration of the stippled and necrotic areas in the two diseases. Moreover, the tubers of stipple streak-infected plants show superficial necrotic lesions and 'eye disease' (resulting in the death of numerous eyes), these features being generally absent from the new Duke of York virus disease. Comparative inoculation experiments (by stem-grafting and sap transference), conducted with this virus and virus Y, resulted in the production of identical symptoms, and the Duke of York mosaic is therefore attributed to virus Y, not reported hitherto for Holland.

A detailed description is given of the reactions (classified in five groups) of a number of well-known potato varieties to tuber-grafting with virus Y. Representative of group (A), characterized by mosaic and drooping of the leaf tips and margins, but no necrosis, are Arran Crest, Arran Victory, Eigenheimer, Epicure, Iris, July Kidney, May Queen, Roode Star, Belle de Fontenay, Bloemgraafje, Gladblaadje, Thorbecke, and Zealand Blue, of which the five last-named invariably harbour stipple streak, Thorbecke and Zealand Blue without external manifestations. Group (B), comprising the varieties Alberta, Bintje, Duke of York, Furore, Gruno, and Triumph, reacts to infection by mosaic, drooping of the leaf tips and margins, a certain amount of rugosity, a few fine veinal necroses, a yellowish to bronze discoloration of the lower leaves, and little or no leaf drop streak. Similar symptoms to the foregoing, with the addition of leaf drop streak, are typical of group (C), comprising Albion, Institut de Beauvais, and Magdeburg Blue. Group (D), besides the features already mentioned, is characterized by numerous superficial stem necroses; it includes Alpha, Bevelander, British Queen, Erdgold, Flava, Friso, Goldwährung, Green Mountain, Industrie, Irish Cobbler, Ninetyfold, President, Preussen, Sickingen, Souvenir, and Up-to-Date. Symptoms reminiscent of stipple streak typify the reaction to virus Y of the group (E) varieties—Dunbar, Yeoman, Monocraat, Noordeling, and Populair; they consist of little or no mosaic, severe, dark, veinal necroses, some necrotic stippling, extensive stem necroses, and leaf drop streak.

It is apparent from these observations that virus Y is equally destructive with stipple streak in respect of foliar damage, but it is less injurious to the tubers, except in the cases of Bevelander and Noordeling, which undergo necrosis as a result of infection by Y but do not respond in this way to stipple streak. The most dangerous attribute of Y, however, is its high degree of infectiousness and ready dissemination by *Myzus persicae*, which is much less active in the spread of stipple streak. Virus Y is also transmissible by sap inoculations, which are seldom successful in the case of stipple streak.

EDDINS (A. H.). **Adjusting P_H reactions of soils with sulfur and limestone to control brown rot of Potatoes.**—*Amer. Potato J.*, xvi, 1, pp. 6–16, 1 graph, 1939.

Continuing his experiments at Hastings, Florida, in the control of potato brown rot or bacterial wilt (*Bacterium solanacearum*) [*R.A.M.*, xvi, p. 271; cf. also xviii, p. 52], the writer confirmed the beneficial results previously reported of a summer (June) application of sulphur at the rate of 800 lb. per acre, followed in November by 3,000 lb.

limestone. Inoculated and commercial flour sulphur produced approximately identical changes in the fine sand or sandy loam soil reaction when used at comparable rates. Tests showed that each 100 lb. sulphur changed the reaction by about P_H 0·15 at 400 lb. and by 0·2 at 500, 600, or 800 lb. per acre. Equal quantities of calcium and dolomitic limestone, applied to sulphured soil, produced about the same changes in the P_H reactions, the maximum yields of healthy potatoes on soils reduced to P_H 3·8 to 3·9 being obtained by treatments of 3,000 lb. limestone per acre.

BERTRAM (L.). **Die Alternaria-Knollenfäule der Kartoffel.** [The *Alternaria* tuber rot of the Potato.]—*Kranke Pflanze*, xvi, 2, pp. 26–32, 2 figs., 1939.

In the autumn of 1937 the Bonn Plant Protection Station received a number of inquiries concerning a tuber rot of Erstling [Duke of York] potatoes, which was found on investigation to be due to *Alternaria solani* [*R.A.M.*, xviii, p. 340] and to occur exclusively on material imported into the Rhine Province from Brandenburg, Pomerania, Grenzmark, and Oldenburg. In 1938 sporadic infection was also observed on Rhenish Duke of York and East Prussian Früheste Delikatess.

In order to ascertain whether infection can be conveyed from diseased to healthy tubers six sound, unwounded tubers were each placed on 22nd November, 1937, in contact with a diseased one; six healthy, lightly scraped tubers were similarly brought into contact with infected ones; and six sound, uninjured tubers were placed next to six healthy ones. No trace of infection was discernible on 10th January, 1938, or in some cases on 21st March, when the tubers were examined. In another test 3 kg. each of diseased and sound tubers were packed in alternate layers in two boxes, and stored in two cellars. In neither instance was there any transmission of infection from the diseased to the healthy tubers, and it seems improbable from these results that the fungus spreads in such a manner during storage, though stored tubers with an externally sound appearance but actually in the incipient phase of the rot may develop infection. From other data it seems unlikely that *A. solani* paves the way to any appreciable degree for secondary rots.

To test the value for seed purposes of tubers infected by *A. solani*, six severely diseased and six healthy were planted on 7th April in a humus-sand-peat mixture in Mitscherlich pots. Not only did the diseased tubers germinate as rapidly and well as the sound ones but they even gave a slightly larger average yield (450 gm. as against 426 gm. per pot). In a field trial the yields per plot of 22·5 sq. m. on 27th August from material planted on 7th May in sandy loam soil were as follows: healthy, stored cool, 64·83 kg.; diseased, stored cold, 62·27; healthy, stored warm, 35·83; and diseased, stored warm, 31·40. There was no trace of *Alternaria* infection on any of the lots of laboratory or field test material on 1st December, 1938, so it may safely be concluded that the quality of infected seed is not depreciated. A further experiment demonstrated the inability of the fungus to infect healthy tubers through diseased soil. It is probable that weather conditions play an important part in the development of *A. solani* on potato tubers, but

further information on the mode of transmission of the rot is necessary for the adoption of rational control measures.

Cook (H. T.) & Nugent (T. J.). **The influence of acid-forming and non-acid-forming fertilizer on the development of Potato scab.**—*Amer. Potato J.*, xvi, 1, pp. 1–5, 1939.

Observations at the Virginia Truck Experiment Station indicate that the incidence and severity of potato scab [*Actinomyces scabies*] are correlated with the soil reaction [*R.A.M.*, xviii, p. 412], being influenced by the type of fertilizer applied only to the extent of any change in the reaction thus induced. Since the disease is able to develop between P_H 4·85 and 5 but not at more acid reactions, future recommendations for local control should aim at the adjustment of the hydrogen-ion concentration to about P_H 4·8, followed by the use of non-acid-forming fertilizers to counteract excess of acidity. The application of acid-forming fertilizers may be advisable on soils where the disease has been so prevalent as materially to impair the quality of the crop, but scab will not be prevented until the reaction has been lowered to at least P_H 4·8. In the 1938 experiments on sandy loam the average scab indices for acid-forming fertilizers at P_H 4·45 to 4·6, 4·65 to 4·8, 4·85 to 5, 5·05 to 5·2, 5·25 to 5·35, and 5·4 to 5·65 were 0, 0, 5·84, 7·79, 12·25, and 40·70, respectively, the corresponding figures for non-acid-forming mixtures being 0·86, 0, 1·60, 9·18, 13·60, and 24·40, respectively.

Reddick (D.). **Scab immunity.**—*Amer. Potato J.*, xvi, 3, pp. 71–75, 1939.

Solanum commersonii, *S. chacoense*, *S. caldasii* var. *glabrescens*, *S. jamesii*, and an unnamed variety have been grown for two years (1937–8) in soil heavily infested by scab (*Actinomyces scabies*) [see preceding abstract] at Cornell, New York, without contracting the disease. All these species possess some very undesirable characters, such as late maturity, long stolons, and bitter flavour (*commersonii* group), which it is hoped to remedy by back-crossing with suitable commercial varieties.

Hill (L. M.). **A study of suberin and suberized deposits of diseased Potato tubers.**—*Phytopathology*, xxix, 3, pp. 274–282, 3 figs., 1939.

Methods are described for determining the difference between suberin and suberized deposit occurring in lesions in potato tubers suffering from several diseases. The petrographical microscope was used to supplement various microchemical tests for the detection of suberin and cellulose in the cell walls. The suberin is anisotropic in normal and wound periderm and in the corky cells surrounding the necrotic areas. The suberized deposit laid down on, or infiltrated in, a cellulose matrix is isotropic, and results from the oxidation and condensation of cell sap drying on the cellulose walls of cells associated with wound periderm and necrosis. Cutin was not found to be associated with necrosis in the diseased tubers examined. The study of the necrotic lesions is facilitated by the distinctive optical properties of cutin, suberin, suberized deposits, and cellulose.

Hérisson-Laparre (E.). **Influence du superphosphate de chaux sur la maladie des taches brunes de la Pomme de terre.** [The influence of superphosphate of lime on the brown spot disease of the Potato.]—*C. R. Acad. Agric. Fr.*, xxv, 1, pp. 45–47, 1939.

The potato disease described by German investigators under the name of 'iron spot' ['Eisenfleckigkeit': *R.A.M.*, xviii, p. 339] has hitherto received little attention in France, and in 1938 the writer therefore organized some preliminary experiments in its control in the Ariège Department by the application to the soil of a superphosphate of lime fertilizer. A highly satisfactory degree of control is stated to have been obtained by the incorporation with the soil, a month before planting, of 1,000 kg. lime and 400 kg. superphosphate of lime per hect. To cite two examples: in a field of Ackersegen potatoes at an altitude of 850 m. above sea-level, partly on infracretaceous crystalline and partly on Devonian carboniferous soil, one out of five tubers from the plants on the untreated portion was diseased, whereas not a single lesion developed on those receiving superphosphate; untreated Institut de Beauvais plants at an altitude of 1,050 m. on crystalline rock and mica-schist yielded tubers with such numerous spots as to be totally unmarketable, while those from a plot fertilized as above were perfectly clean. One of the farmers participating in the tests reported that 'Eisenfleckigkeit' scarcely ever developed on potatoes following clover, to which phosphoric acid is regularly applied.

Garrett (S. D.). **Soil-borne fungi and the control of root disease.**—*Tech. Commun. Bur. Soil Sci., Harpenden*, 38, 54 pp., 1939.

The author reviews and critically discusses, with numerous references to the relevant literature, some of the more important investigations [most of which have been noticed from time to time in this *Review*] recently carried out in different countries on the control of a large number of soil-borne fungal diseases of crop plants. The main topics dealt with include the part played by fungi in the soil, plant sanitation, the elimination of infectious material from the soil by fungicides and heat treatment, mechanical methods, crop rotation, and biological control, the adjustment of soil conditions to check parasitic activity, and the increasing of host resistance by modifications in environment. The paper concludes with an eight-page bibliography.

Waksman (S. A.), Cordon (T. C.), & Hulpoi (N.). **Influence of temperature upon the microbiological population and decomposition processes in composts of stable manure.**—*Soil Sci.*, xlvii, 2, pp. 83–98, 7 pl., 2 graphs, 1939.

The authors show that the conservation of essential nutrient elements, especially nitrogen, in stable manures depends on the control, by regulation of temperature, of the rapidity of decomposition of the compost [*R.A.M.*, xviii, p. 342]. Nitrogen was conserved only when immediate decomposition set in, and was lost when delay occurred through too high or too low temperatures. Decomposition was most rapid at 65° C., when bacteria and Actinomycetes were mainly concerned; followed by that at 50°, when thermophilic fungi [loc. cit.] were very active in addition. Temperatures of 75° and 28° were unfavourable.

Masalab (N. A.). Болезни лекарственных и некоторых технических растений, вызываемые видами **Sclerotinia.** [Diseases of medicinal and of some industrial plants caused by species of *Sclerotinia.*] —*Sovetsk. Bot., 1938*, 6, pp. 67–83, 3 figs., 1 graph, 1938. [Received April, 1939.]

The author states that a severe damping-off of tobacco and pyrethrum [*Chrysanthemum cinerariaefolium*] seedlings is caused in the Crimea by *Sclerotinia sclerotiorum* and *S. minor* [*R.A.M.*, xvii, pp. 128, 433], this being, so far as he is aware, the first record of *S. minor* in U.S.S.R. *S. sclerotiorum* has also been found in the Crimea attacking the opium poppy, valerian [*Valeriana officinalis*], and fullers' teasel (*Dipsacus fullonum*), all three of which are new hosts for this fungus. Observations showed that the sclerotia of both species produce fully mature apothecia in nature every year under the local conditions. *S. minor*, both in pure culture and in nature, forms numerous sclerotia, which were shown to be capable of germinating without any rest period. Sclerotia associated with a wilt of *Trachyspermum copticum*, a stem and collar rot of *Gentiana lutea*, and a die-back of *Cassia obovata* were shown in culture to belong to species of *Botrytis*, and were never observed to produce apothecia either in nature or in culture.

Francis (C. B.). **Sugarcane smut.**—*Madras agric. J.*, xxvi, 12, pp. 468–474, 1938. [Received April, 1939.]

A popular account is given of sugar-cane smut (*Ustilago scitaminea*) in Madras [*R.A.M.*, xvii, p. 501] and its control by the removal of diseased material from the field and its destruction by 15 minutes' immersion in boiling water. Since 1934–5 regular searches have been made for infected plants on the estates of the East India Distilleries and Sugar Factories, Ltd., Nellikupam, starting about May and finishing towards the end of the year, with the result that the incidence has declined from 1,099 over 150 acres (average per acre 7) in 1935–6 to 55 over 112 acres (under one per two acres) in 1937–8; up to the end of August, 1938, 156 cases were found over 108 acres, the cost of the work amounting to under 8 annas per acre as compared with Rs. 1.12.8 in 1935–6. In 1934–5 the average number of Badilla canes removed was 540 per acre (all inspections), the corresponding figures for Co. 281 and P.O.J. 2878 being 119 and 16, respectively; in 1937–8 only five plants per acre of Badilla, one of Co. 281, and none of P.O.J. 2878 had to be eliminated for smut. In 1937 similar inspections were instituted among the peasants' cane, the removals among which amounted to 152, 51, and 14 per acre for Badilla, Co. 281, and P.O.J. 2878, respectively. Endomychid beetles are believed to carry the smut spores on their bodies and so asist in the spread of infection.

Martin (J. P.). **Pathology.**—*Rep. Hawaii. Sug. Exp. Sta., 1938* (ex *Proc. Hawaii. Sug. Pl. Ass., 1938*), pp. 30–38, 1939.

In this report [cf. *R.A.M.*, xvii, p. 487] it is stated, *inter alia*, that brown stripe (*Cochliobolus stenospilus*) [ibid., xv, p. 397] of sugar-cane was still of major importance in certain localities of Hawaii. In general, sugar-cane varieties exhibit little resistance to the disease.

Chlorotic streak of sugar-cane [ibid., xviii, p. 274], associated with high soil moisture and sometimes with potassium deficiency, was more prevalent along the Hilo coast of Hawaii than in former years. For the control of this disease it is recommended to use only healthy cuttings for planting or in doubtful cases to treat them in hot water (52° C. for 20 minutes) prior to planting.

The incidence of sugar-cane mosaic [ibid., xviii, p. 346] is stated to have been the lowest for many years, owing mainly to the planting of resistant varieties, the selection of healthy planting material, and roguing diseased plants.

Bacterium solanacearum [see above, p. 473], causing bacterial or brown rot of potatoes, was found in pot experiments to be carried in the soil, since plants grown in infested soil contracted the disease while those grown in steam-sterilized soil remained healthy. A parasitic organism closely resembling *Bact. solanacearum* was isolated from purslane (*Portulaca oleracea*).

NAUMOV [NAOUMOFF] (N. A.). **Clés des Mucorinées (Mucorales).** [Keys to the Mucorineae (Mucorales).] Translated from the second Russian edition, with additional notes by the author, by S. Buchet and I. Mouraviev, with a preface by P. Allorge.—(*Encycl. mycol.*, Vol. IX), 137+xxxvi pp., 82 figs., Paris, Paul Lechevalier, Editeur, 1939. 100 francs.

This French translation of Naoumoff's Key to the Mucorales [*R.A.M.*, xv, p. 56] includes nearly double the number of figures given in the original, drawn by Buchet to a larger scale. An appendix has also been added by the same translator setting out the differences between the author's views and those expressed by Zycha in his 'Kryptogamenflora der Mark Brandenburg' (1935), summing up the present state of knowledge on the sexuality of the fungi dealt with, and giving a full bibliography of works presenting the original diagnoses of the species or details of their sexual characters.

MARCHIONATTO (J. B.). **Notas micologicas.** [Mycological notes.]—*Physis, B. Aires*, xv, pp. 133–144, 9 pl., 1939.

An annotated list is given of 27 species of Argentine fungi, of which the following may be mentioned: *Asperisporium caricae* on papaw [*R.A.M.*, xvi, p. 729]; *Cephalothecium* [*Trichothecium*] *roseum* on cotton bolls; *Cercospora epicoccoides* on *Eucalyptus globulus* [ibid., xiv, p. 471] and *E. rostrata*; *C. cichorii* on chicory [ibid., x, p. 430]; *Cladosporium paeoniae* on peony (*Paeonia sinensis*) [*P. albiflora*: ibid., xvi, pp. 20, 464]; *Entyloma dahliae* on dahlia [ibid., xvii, pp. 294, 752]; *Fabraea maculata* on pear [ibid., xviii, p. 259]; *Gloeosporium cyclaminis* on *Cyclamen persicum* [ibid., xv, p. 657]; the imperfect stage (*Phoma uvicola*) of *Guignardia bidwellii* on the vine [ibid., xvii, p. 727]; *Mycosphaerella rubi* [ibid., xvii, p. 190] and *Elsinoe veneta* on raspberries; *Sclerotinia opuntiarum* on *Opuntia* spp.; *Sclerotium bataticola* [*Macrophomina phaseoli*] on maize [ibid., xiii, p. 571]; *Spondylocladium atrovirens* on potatoes; and *Taphrina aurea* on *Populus* sp. [ibid., xvi, p. 642].

Peyronel (B.). **La forma basidiofora ('Helicobasidium purpureum' Pat.) della Rhizoctonia violacea in Italia.** [The basidium-bearing stage (*Helicobasidium purpureum* Pat.) of *Rhizoctonia violacea* in Italy.]—*Nuovo G. bot. ital.*, N.S., xlvi, 1, pp. 146–148, 1939.

The author records, for the first time in Italy, the presence of *Helicobasidium purpureum* (the perfect form of *Rhizoctonia crocorum*), found in the province of Siena on the collar of *Acer campestre* and *Urtica dioica* [*R.A.M.*, xii, p. 353]. In the author's opinion, the development of the fungus was favoured by the humidity of the soil, its richness in organic material, and its acidity [cf. ibid., ix, p. 667]. Control would appear to consist in liming or in the application of alkaline dressings, especially calcium cyanamide.

Cartwright (K. St. G.). **Presidential address. The relation between field and laboratory work in mycology.**—*Trans. Brit. mycol. Soc.*, xxii, 3–4, pp. 222–238, 1939.

In his presidential address to the British Mycological Society in September, 1937, the author emphasizes the need for the encouragement of systematic mycology and critically discusses some of the criteria used in the classification of the Polypores, stressing the value of cultures in the identification of wood-rotting fungi.

Matsumoto (T.). **Mites in relation to leaf curl-like Tobacco disease.**—*Trans. nat. Hist. Soc. Formosa*, xxix, 187, pp. 90–91, 1939.

Referring to his previous studies [*R.A.M.*, xvii, p. 629] on the leaf curl or 'kroepoek'-like disease of tobacco the author states that the appearance of glossy areas on the lower surface of diseased leaves has been found to be due to injuries made by the mites observed to be present. His interpretation of the results of his experiments on the mode of transmission was based on this symptom as a criterion of infection and therefore refers to the attack of the animal parasite and not to the virus. There is no doubt that the mite, possibly a species of *Tarsonemus*, is responsible for the stunting of plants as well as for the shiny appearance and leaf curl, but since infected plants have frequently produced new curled or malformed, lustreless leaves even after the removal of diseased material and treatment of the plants with nicotine sulphate, it is thought that a virus may occasionally be implicated in the causation of the disorder.

Vinson (C. G.), McReynolds (D. K.), & Gingrich (N. S.). **Virus protein of mosaic disease of Tobacco.**—*Res. Bull. Mo. agric. Exp. Sta.* 297, 12 pp., 1 fig., 1 diag., 1 graph, 1939.

In a study on the virus of tobacco mosaic [*R.A.M.*, xviii, p. 415], carried out in Missouri in 1937, crystalline-like preparations of the virus were isolated from the juice of diseased plants and from more highly purified fractions of the virus by adding anhydrous sodium sulphate after the reaction had been adjusted to P_H 4·0. The crystalline material was almost entirely freed from ash by washing with dilute acetic acid. The ash content of the washed crystals was between 0·32 and 1·52 per cent., that of nitrogen between 15·8 and 16·2 per cent.,

and phosphorus was also present. The material can easily be freed from the last traces of brown pigment normal to juice of tobacco plants by shaking a phosphate dispersion with ether, whereupon the pigment is carried along on the droplets of ether and can readily be drawn off. The crystalline bodies averaged 30 to 40 by 1 μ, but longer particles were obtained with more concentrated solutions of the virus (1 to 2 per cent.). The crystalline material was easily redispersed and recrystallized any number of times. Fifteen X-ray diffraction patterns obtained with samples of the crystalline material showed spacings as great as 14·3 Å and as low as 2·43 Å, thus disagreeing with the spacings greater than 14·3 Å and not smaller than 3·39 Å observed by Wyckoff and Corey [ibid., xvi, p. 281] in virus material prepared according to Stanley's method. It is suggested that the absence of long spacings in the virus material prepared by the sodium sulphate method may indicate that it is composed of smaller molecules, and hence has a lower molecular weight than that studied by others.

PINCKARD (J. A.) & BOZOVAISKY (L.). **The effect of flue-curing on the infectivity of ordinary Tobacco mosaic virus (Tobacco virus 1).**—*Phytopathology*, xxix, 3, pp. 242–250, 2 graphs, 1939.

Following a severe epidemic at Chatham, Virginia, in 1937, the tobacco mosaic virus (tobacco virus 1) was experimentally shown to retain its virulence in flue-cured leaves [*R.A.M.*, xiii, p. 189] removed from the lower, middle, and upper tiers of the first four barns cured and in the lower and middle tiers but not upper tiers of the fifth. It was completely inactivated in the lower tiers of seven barns of cured tobacco in 1937, but the final drying temperatures (180° F. and upwards for 24 hours) at this position were substantially higher than those normally required for curing. Wide temperature variations (up to 50° F.) were recorded within the same wood-fired barns. The maximum temperatures reached in five barns cured with an oil-burning heating unit in 1938 ranged from 167° to 175° and were thus below the thermal death-point of the tobacco mosaic virus. Infected leaves lost weight, cured, and became dry at the same temperature and time as healthy foliage. The temperatures requisite for a satisfactory 'cure' varied, the leaves attaining the desired condition in one instance at 158° after 73 hours, and in three others at 175°, 130°, and 183° after 80, 111, and 84 hours, respectively; as indicated above, these figures are in general appreciably below the thermal death-point and time necessary for total virus inactivation.

THORNBERRY (H. H.) & MCKINNEY (H. H.). **Purification of Nicotiana virus 6 protein.**—*Phytopathology*, xxix, 3, pp. 250–260, 1 fig., 1939.

Canary Island material of *Nicotiana* virus 6, the agent of mild, dark green mosaic of tobacco [*R.A.M.*, ix, p. 260; xvii, p. 706] was purified from crude plant juice by crystallization at P_H 4·5 and 0·3 saturation of ammonium sulphate, using a modification [ibid., xvii, p. 416] of Stanley's improved method [ibid., xvi, p. 211]. Infectivity of the diseased plant (Wisconsin Havana seed tobacco) juice was associated with the presence of a protein resistant to tryptic digestion [ibid., xvii, p. 630], elemental analysis of which (after dialysis) indicated 13·28

per cent. nitrogen, no phosphorus, and 0·16 per cent. sulphur, the corresponding figures for non-dialysed protein being 11·90, 0·33, and 1·33 per cent., respectively. Under dark-field illumination the unit crystals of the protein are elliptical particles, 0·3 to 1·6 by 0·3 to 0·5 μ, whereas those of *N.* virus 1 are acicular and measure 3·2 to 4·2 by 0·4 to 0·5 μ [ibid., xvi, p. 570 *et passim*]. Both virus proteins, on standing, aggregate into threads [ibid., xviii, p. 211] or bundles of unit crystals. *N.* virus 6 was dispersed at P_H 7·5 to a point at which no particles were discernible, and precipitated at P_H 4·5 into elliptical crystals. At intermediate hydrogen-ion concentrations the dimensions and numbers of the precipitated particles bore a direct proportion to the degree of acidity. At P_H 7·5 in the presence of trypsin, the protein was precipitated into typical crystals.

KAUSCHE (G. A.). **Über die Bildung von hexagonalen Viruskristallen aus Suspensionen des Tabakmosaikvirus in vitro.** [On the formation of hexagonal virus crystals from suspensions of the Tobacco mosaic virus *in vitro.*]—*Naturwissenschaften*, xxvii, 5, pp. 77–78, 2 figs., 1939.

In order to verify Helen Purdy-Beale's working hypothesis that the hexagonal crystals in the epidermal cells and trichomes of mosaic-diseased tobacco plants are products of supersaturated protein solutions [*R.A.M.*, xvi, pp. 282, 569; xviii, p. 416], the writer made a microscopic study of the expressed sap of infected plants, purified with animal charcoal and mixed with the virus-containing centrifuged sediment precipitated with ammonium sulphate. The hexagonal crystals were observed to develop out of the fasciculate acicular deposits, thereby supporting the above-mentioned hypothesis and affording the first definite proof of the ability of the virus, under appropriate conditions, to pass *in vitro* from one form to the other.

SCHWEIZER (J.). **Jaarverslag Tabak over Juli 1937 t/m Juni 1938.** [Annual report on Tobacco from July, 1937, to June, 1938.]—*Meded. besoek. Proefst.* 62, 59 pp., 1938.

The following items (other than those already noticed from a different source) are of interest in the phytopathological section (pp. 37–40) of this report [cf. *R.A.M.*, xvi, p. 413] from Java. Tjemara (frenching) was present in tobacco plantations on soils of a particular constitution [ibid., xvii, p. 847]; experimental evidence points to thallium toxicity as an important factor in the etiology of the disturbance.

Mosaic and kroepoek or krekoh [leaf curl: ibid., xvii, p. 629; xviii, p. 90] were among the most prevalent virus diseases.

Stem rot [or hollow stem] (*Bacillus* [*Erwinia*] *aroideae*) [ibid., xvii, pp. 296, 490] developed locally during harvesting in a dry spell when the precaution of heating the barns had been omitted. Slime disease (*Bacterium solanacearum*) [ibid., xviii, p. 279] occurred in a severe form in tobacco stands following the susceptible groundnut, and was also unusually widespread on rice fields; generally speaking, however, the disease is of little importance in the Besoeki region.

Phytophthora parasitica var. *nicotianae* [ibid., xviii, p. 419] developed in an erratic manner in the abnormal weather conditions obtaining

during the period under review, injurious attacks being observed in areas where heavy rains were succeeded by short dry intervals, while practically no spread of infection took place where lengthy periods of drought followed the wet season. Not only old harvested leaves, but also young ones were seriously damaged by *Cercospora nicotianae*, which further infected the growing crop with unprecedented severity during the wet weather.

GRATZ (L. O.) & KINCAID (R. R.). **Tests of cigar-wrapper Tobacco varieties resistant to blackshank.**—*Bull. Fla agric. Exp. Sta.* 326, 18 pp., 1 fig., 1938. [Received May, 1939.]

In field tests conducted in Florida from 1933 to 1936 inclusive, the cigar-wrapper tobacco varieties 301, 94–2, 94–4, and Rg proved to be highly resistant to black shank (*Phytophthora parasitica* var. *nicotianae*) [see preceding abstract], the percentage of plants wilted or killed by the disease during the tests averaging 5·0, 8·25, 11·0, and 2·5, respectively, compared with 62·75 in the susceptible control (Connecticut Round Tip). Rg, closely followed by 301, was also found to be somewhat superior to others in quality and other important characteristics.

KINCAID (R. R.) & TISDALE (W. B.). **Downy mildew (blue mold) of Tobacco.**—*Bull. Fla agric. Exp. Sta.* 330, 28 pp., 11 figs., 1 map, 1939.

This is a semi-popular account of the downy mildew disease of tobacco (*Peronospora tabacina*) [*R.A.M.*, xviii, p. 417] in Florida, where it first appeared in 1921, then disappeared till the general outbreak in 1931, and has been prevalent every year since. The symptoms of the disease in the plant bed and the field, the influence of weather on the development of the disease, and the life-history of the causal fungus are described. Control measures recommended for use in the State include cultural practices, spraying with copper oxide-oil emulsion sprays, and vapour treatment with either benzol or paradichlorobenzene. The relative effectiveness and the costs of various treatments are discussed.

WOLF (F. A.). **Downy mildew of Tobacco in Brazil.**—*Phytopathology*, xxix, 3, p. 291, 1939.

About a year before the time of writing the author was informed that downy mildew had occasioned serious losses during two seasons on tobacco seedlings in the State of Rio Grande do Sul, Brazil. Material collected in September, 1938, and forwarded to the author showed glabrous oospores of *Peronospora tabacina* [see preceding abstract] distinct from those of *P. nicotianae*, first collected at Buenos Aires [*R.A.M.*, iv, p. 573] by Spegazzini in 1888. *P. tabacina* is thought to be of recent introduction into South America.

TROTTER (A.). **I Ficomiceti parassiti della pianta del Tabacco.** [Phycomycetes parasitic on the Tobacco plant.]—*Boll. tec. Tab.*, xxxv, 4, pp. 187–219, 4 pl., 10 figs., 1938. [English summary. Received April, 1939.]

This is a copiously annotated list of 18 Phycomycetes pathogenic to

cultivated tobacco, of which so far only *Asterocystis radicis* [*R.A.M.*, xv, p. 751] and *Pythium de Baryanum* have been definitely recorded for Italy, where the occurrence of *Olpidium brassicae* [ibid., xvi, p. 822], however, is also considered to be probable.

HOPKINS (J. C. F.). **Diseases of Tobacco in Southern Rhodesia. (Supplement I. 1932 to 1938.)**—*Rhod. agric. J.*, xxxvi, 1, pp. 45–65, 4 pl. (1 col.), 1939.

This is a supplement to the author's handbook on the diseases of tobacco in Southern Rhodesia published by the Department of Agriculture in 1931 [*R.A.M.*, xi, p. 206]. During the last six or seven years a distinct improvement in disease control is stated to have taken place owing to the growing experience of tobacco farmers in diagnosing diseases in their early stages and to the adoption of spraying both in seed-beds and lands as a general practice. Such diseases as wildfire [*Bacterium tabacum*: ibid., xvi, p. 2], angular spot [*Bact. angulatum*: ibid., xvii, p. 776], and brown spot (*Alternaria longipes*) [ibid., xviii, p. 373] no longer ruin whole districts or crops, but are kept under reasonable control if treated in their early stages. Although priming has been repeatedly proved to keep frog-eye [*Cercospora nicotianae*: loc. cit.] in check, there appears to be no appreciable reduction in the average yearly damage caused by it, the majority of growers being still unaware that the industry loses not less than £100,000 annually through this disease in the field and barn.

Since 1931 *Pythium de Baryanum* and *P. ultimum* have been found to cause damping-off of tobacco seedlings in addition to *Rhizoctonia* [*Corticium*] *solani*, but neither of the two has yet been observed affecting transplants.

The brown spot disease, for which the name *Alternaria longipes* (Ell. & Ev.) Tisd. & Wadk. has been adopted [ibid., xii, p. 748], has spread since 1931 throughout the country, despite all efforts to keep it under control, and occurs in the most severe form on red soils of the middle veld. The disease is favoured by high atmospheric humidity with frequent rains, and by relatively high temperatures [cf. ibid., x, p. 764]; above 80° F. the disease develops in its most severe form, while below 75° it does not become epidemic. Heavy-bodied leaves were found to be more susceptible than bright ones. Experimental inoculations produced very severe infection on fire-cured (Western) tobacco growing on red soil, but only a very mild one on the flue-cured Orinoco White Stem variety growing in sandy loam, identical results being obtained with a culture of the fungus received from Nyasaland. Field experience showed that successful control of the brown spot disease must aim at prevention of spore formation during the active growth of the plant. Severe epidemics and much damage are most likely to occur if the disease becomes widespread before topping and if spots are allowed to become numerous on the lower leaves; hence the importance of early diagnosis and rapid action. Priming should be commenced at the first signs of the disease and spotted leaves removed and destroyed by burning before abundant spore formation sets in. In conjunction with priming and destroying the first infected leaves, spraying with Bordeaux mixture or dusting with copper-lime dust,

repeatedly if necessary, when the plants are still young, has become a successful routine practice in certain districts. Affected stalks and seed pods should be destroyed immediately after reaping, as the fungus may hibernate in the infected tissues. In ploughing in crop residue all stalks must be carefully turned under. It is as yet uncertain whether or not the fungus is entirely killed by three months' composting. Seed capsules are attacked by the fungus, but the possibility of seed infection is considered negligible, as all seeds are bagged early in the season whilst the plants are still in flower. Seed treatment should in any case prevent the transmission of disease by this means. Brown spot has not yet been recorded in seed-beds in Rhodesia.

VAN KOOT (Y.). **De belangrijkste virusziekten van de Tomaat in Nederland.** [The most important virus diseases of the Tomato in the Netherlands.]—*Meded. Inst. Phytopath., Wageningen*, 83, 25 pp., 6 figs., 1939. [English summary.]

The most widespread virus disease of tomato in Holland is stated to be single-virus or glasshouse streak (*Lycopersicum* virus 1) [*R.A.M.*, xiv, p. 261], the properties of which closely resemble those of the ordinary tobacco mosaic virus (*Nicotiana* virus 1). The symptoms of the disease are very variable and include mosaic (liable to be accompanied in the spring at fairly high temperatures and relatively low light intensity by persistent fern leaf), mosaic plus foliar necrosis, mosaic plus foliar, stem and fruit necrosis, and necrosis alone. All the symptoms may be obtained by inoculation with the juice of plants showing any type of symptom, mosaic being apt, however, to predominate over necrosis. *Solanum nigrum*, a common glasshouse weed, is a host of single virus streak. Although the infective principle is introduced through the roots only with great difficulty under experimental conditions, much infection develops from the soil in nature, especially soon after planting, by contact of the young leaf and stems parts with the soil.

The inactivation of single-virus streak in the soil was found to be effected by oxidation. In soil maintained for seven months in an atmosphere of carbon dioxide the virus concentration remained unaltered. In pure river sand the inactivation process is complete in two months, in humus sand at least 5 per cent. of the virus is still in an active state after seven months, while in heavy clay a considerable period is likely to elapse before infectivity is lost. Total inactivation did not result from a spell of a fortnight's moderately severe frost (—5 to —10° C.). Fresh seed from diseased plants was found to give rise to a maximum of 1 per cent. infection.

Mixed-virus streak [loc. cit. *et passim*], caused by a combination of tobacco mosaic (*N.* virus 1) and potato virus X (*Solanum* virus 1), is also of fairly frequent occurrence, producing symptoms similar to those of single-virus streak in an intense form, but with more pronounced necrosis. In greenhouse experiments in the joint control of both disorders (single-virus streak predominating) the beneficial effects of hygienic precautions were to some extent neutralized by soil infection; this was prevented, however, by the application to the greenhouse soil of a thin layer of river sand and by avoiding splashing soil on the plants during watering. Other methods of soil disinfection include formalde-

hyde treatment and steaming (ten minutes at 90° or one hour at 80°), the latter resulting in 99 per cent. virus inactivation. Liberal applications of potash also tended to reduce the severity of the symptoms, which were often limited to the mosaic type only. Attention should also be paid to the use of healthy seed, nursery bed disinfection, general sanitation, and eradication of *S. nigrum*.

Blood (H. L.). **A method of measuring the relative resistance of varieties of Tomato and Bean to curly top.**—*Proc. Utah Acad. Sci.*, xv (*1937–8*), pp. 21–24, [? 1938. Abs. in *Exp. Sta. Rec.*, lxxx, 3, p. 352, 1939.]

In five years' tests, the following method of determining the relative resistance of tomato and bean to curly top [*R.A.M.*, xviii, p. 77] has proved to be fairly reliable. The seeds are drilled as soon as the danger of frost is over, and at the primary leaf stage, viruliferous insects (*Eutettix tenellus*) are placed on plants of each selection. Additional plants are inoculated each week for 3 or 4 weeks and then bi-weekly, until 8 inoculations have been made. For comparative weekly readings the cycle of disease development is divided into stages 1 (healthy) to 5 (complete death). From the data so obtained the weekly progress of the disease and the total response in the different selections are obtained. A coefficient indicates the relative resistance of the various selections.

Katser (Annie). **Ein Beitrag zur Anwendung des Antagonismus als biologische Bekämpfungsmethode unter besonderer Berücksichtigung der Gattungen Trichoderma and Phytophthora.** [A contribution to the application of antagonism between fungi in biological control with special reference to the genera *Phytophthora* and *Trichoderma*.]—*Boll. Staz. Pat. veg. Roma*, N.S., xviii, 2, pp. 195–217, 1938; 3, pp. 221–330, 4 pl., 18 figs., 1938 (issued 1939). [Italian summary.]

In a study on mutual antagonism between *Trichoderma* and *Phytophthora* preliminary tests indicated that the former behaves parasitically towards the latter [cf. *R.A.M.*, xvi, p. 558 *et passim*]. When inoculations of *P. citrophthora* were made on filtrates of a culture of *T. koningi* on carrot broth no growth occurred within a month, though sparse growth took place on the filtrate of a culture of *T. koningi* grown and maintained in darkness. In further experiments complete growth failure did not recur and it is, therefore, assumed that after repeated transfers on artificial media *T. koningi* lost some of its antagonism. The growth of *P. citrophthora* was, however, sparse. While the filtrates from three-day-old cultures of *Trichoderma* permitted good growth of *P. citrophthora*, those from cultures of increasing age caused progressively greater inhibition of growth, inhibition being almost complete when the filtrate was from cultures over 14 days old.

By heating the filtrates of *T. koningi* to between 60° and 120° C., their toxic action was reduced. Filtrates of *T. lignorum* had a less marked inhibiting effect on the growth of *P. citrophthora* than filtrates of *T. koningi*. Those of the latter were less toxic to *P. parasitica* than to *P. citrophthora*.

Inoculations of *T. koningi* into its own filtrates indicated that the fungus produces autotoxins. The filtrates of *P. parasitica* and *P. citrophthora* retarded vegetative development and conidial production in *T. koningi*.

In greenhouse pot tests tomato collar rot due to *P. parasitica* [ibid., xvi, p. 132 and next abstract] was much reduced following soil inoculation with *T. koningi* before sowing. *T. koningi* inoculated alone into the soil in similar tests increased the germination of tomato seed and improved seedling growth, though inoculation after sowing had no effect. In combined inoculations with *T. koningi* and *P. parasitica* on tomato and apple plants and fruits the activity of the latter fungus was unaffected by the former.

Katser (Annie). **Weitere Studien zur Anwendung des Antagonismus als praktische Bekämpfungsmethode des Keimlingssterbens der Tomaten.** [Further researches on the practical application of antagonism as a means of controlling damping-off of Tomato seedlings.]—*Boll. Staz. Pat. veg. Roma,* N.S., xviii, 3, pp. 367–382, 4 pl., 2 figs., 1 diag., 1938 (issued 1939). [Italian summary.]

In experiments made to ascertain whether the antagonism shown by *Trichoderma koningi* towards *Phytophthora parasitica* [see preceding abstract] could be turned to practical account in the control of tomato seedling damping-off rot caused by the latter fungus, tomato plants were grown in hot-beds inoculated with *P. parasitica* alone, *T. koningi* alone, with *T. koningi* and then with *P. parasitica,* and untreated. In the first series of experiments the total numbers of seedlings per bed were 207, 722, 557, and 807, respectively, and in the second series the corresponding numbers were 98, 647, 287, and 837. In another experiment the results were inconclusive.

Wolf (F. T.) & Wolf (F. A.). **A study of Botryosphaeria ribis on Willow.**—*Mycologia,* xxxi, 2, pp. 217–227, 4 figs., 1939.

Willow canker caused by *Botryosphaeria ribis* [*R.A.M.*, xviii, p. 193] is stated to be widely prevalent on species of *Salix* throughout the south-eastern United States. The first symptoms of the disease are occasional blighted twigs and branches bearing elongate, depressed lesions which girdle the branches below the dying parts. Later on numerous circular, crateriform cankers, $\frac{1}{4}$ to $\frac{1}{2}$ in. in diameter, develop on the trunk and larger branches, as many as 100 occurring on one foot-length of trunk; by anastomosis they may give rise to larger cankers several inches in length. The bark in the cankered areas becomes dry and cracked and in spring and early summer an exudate attractive to ants accumulates on the surface of the lesion or flows from it. Within a year or two the cankers may completely girdle the trunk and the entire tree may be killed in three or four years. Dark stromata are visible protruding from cracks in the willow bark and the characteristic contents of fructifications of *B. ribis*, with one to six locules in each stroma, are revealed by cutting away the bark parallel to the surface. Only pycnidia of the *Dothiorella* stage occur on current season's willow twigs, but perithecia are found on older branches. Spermogonia develop in the autumn and winter on pycnidial stromata, producing hyaline, oval to

elongate microconidia, 2 to 3 by 1 μ. Both conidia and ascospores of *B. ribis* germinated readily on malt agar, germ tubes several times the length of the spore being formed within 3 to 4 hours. Pycnidial stromata of the *Dothiorella* type were produced in cultures derived from either conidia or ascospores. Zonation occurred in cultures kept under conditions of alternate light and darkness, but not in those kept in total darkness. Sectoring took place in a few cultures under both conditions. The development of the conidia, asci, and ascospores of *B. ribis* was studied cytologically and is described. The cells of the conidiophore are uninucleate, the conidia multinucleate, the ascospores uninucleate at first but become multinucleate later, and the hyphal cells multinucleate for a period following germination.

CAMPBELL (W. A.) & DAVIDSON (W.). **Poria andersonii and Polyporus glomeratus, two distinct heart-rotting fungi.**—*Mycologia*, xxxi, 2, pp. 161–168, 2 figs., 1939.

As a result of a study carried out in Washington, United States, the authors recognize the wood-rotting species *Poria andersonii* [*R.A.M.*, xvi, p. 505] and *Polyporus glomeratus* [loc. cit.], hitherto not clearly separated by mycologists and pathologists, as two distinct fungi on the basis of differences exhibited in nature and in culture. *Poria andersonii*, commonly isolated from trunk decay of living oak trees throughout the middle-western States but also reported on willow, poplar, and hickory, is stated to enter through branch stubs, fire scars, and other injuries and to cause a white decay similar to that caused by *Fomes everhartii* [ibid., x, p. 350]; it apparently always develops under the bark and has no pileus. Its setal hyphae are much smaller than those of *Polyporus glomeratus* and their distribution in the sporophores is more erratic and usually difficult to demonstrate. *P. glomeratus* causes a white to light brown spongy heart rot of maples, occurs also on beech, and is common on sugar maple in some areas in the Lake States; it develops on the outside of the bark, usually with some indication of a pileus, and has large setal hyphae easily detected in the sporophores. On malt agar *Poria andersonii* forms a mat typically yellow at all ages, and usually woolly or felty in texture. It has an optimum temperature of about 35° C., and grows twice or three times as fast as *Polyporus glomeratus*, which forms a white mycelium about the inoculum (which becomes compacted and olive-buff later on), an optimum temperature of 25°, and produces usually larger and more opaque setal hyphae, 7 to 16 μ in diameter. *Poria andersonii* produces short, bulbous setae on the mat surface, especially in staled areas, the setal hyphae ranging from 5 to 8 μ in diameter.

ESCHERICH (K. L.). **Der Eichenkropf und seine Ursachen.** [Oak 'goitre' and its causes.]—*Forstwiss. Zbl.*, lxi, 3, pp. 75–81, 8 figs., 1939.

Oak canker or 'goitre' in Germany [*R.A.M.*, xvi, p. 353] has been variously attributed to fungi (*Stereum rugosum* [ibid., xiii, p. 810] and *Nectria ditissima* [ibid., xiv, pp. 338, 407; xvii, p. 269]), insects, bacteria, and traumatic agencies, but recent studies at Sopron, Hungary, by A. Kelle (*IX. Kongr. int. Verb. forstl. ForschAnst., 1936*) are stated to have proved beyond a doubt that the excrescences are produced by the aphid *Lachnus roboris* as a sequel to incorrect silvicultural methods.

SIEMASZKO (W.). **Zespoły grzybów towarzyszących kornikom polskim.** [Fungi associated with bark beetles in Poland.]—*Planta polon.*, vii, 3, 54 pp., 5 pl., 3 figs., 1939. [English summary.]

The author studied the association of fungi with bark beetles on material collected from 1933 to 1937 in different parts of Poland. Constant associates of *Ips typographus* on spruce (*Picea excelsa*) [*P. abies*] were Saccharomycetaceae, mostly of a type closely resembling *Endomyces bisporus*, and the blue-staining fungi *Ophiostoma penicillatum* n.comb. [*Ceratostomella penicillata*], *O. polonicum* n.sp., and *Graphium pycnocephalum*; of *I. sexdentatus* on pine (*Pinus sylvestris*), Saccharomycetaceae and the blue-staining fungi *O.* [or *C.*] *ips* and *O.* [or *C.*] *pini*; of *Myelophilus piniperda* on pine, *O. pini*; and of *Scolytus scolytus* and *S. multistriatus* on elm (*Ulmus foliacea*), Saccharomycetaceae and the blue-staining fungus *G.* [*C.*] *ulmi*. Descriptions are given of these fungi and many others occasionally associated with the beetles.

The blue-staining *O. minutum* n.sp., an occasional associate of *I. typographus*, has superficial, brown, slightly hairy or smooth, subglobose perithecia 84 to 140 μ in height and 74 to 125 μ in diameter, with a rostrum 98 to 140 by 14 to 20 μ; the ascospores are hyaline, filiform-acicular, curved, 8 to 10 (12·5) by 1 to 1·5 μ. *O. penicillatum* has the conidial stage *Leptographium penicillatum*. *O. polonicum* n.sp. has conidial stages of both *Leptographium* and *Cephalosporium* types. The intensely brown-staining *Stysanus ulmi* n.sp. is an occasional associate of *Scolytus scolytus* and *S. multistriatus* on elms; it has synnemata 234 to 312 μ in height by 15·6 to 23·4 μ in diameter or 130 to 195 by 26 to 34·4 μ; conidia hyaline (fuliginous in mass), truncate at both ends, one more obtuse than the other, 3·8 to 5 by 1·9 to 2 μ. Latin diagnoses are given of the new species.

The author does not recognize the genus *Grosmannia* established by Goidànich [*R.A.M.*, xv, p. 826], which was made to include certain species of *Ophiostoma* on the grounds that these species differed from other representatives of the genus in having a conidial stage of the *Leptographium* type. However, as *O. ips* is known to have a *Graphium* conidial stage as well as one of the above-mentioned type, and the imperfect stages of *Mycosphaerella* are variable, it is considered possible for the genus *Ophiostoma* to have conidial stages of the types *Chalara*, *Leptographium*, *Graphium*, *Cladosporium*, *Cephalosporium*, and *Thielaviopsis*.

The most harmful wood-staining fungi in Poland are *O. pini* on pine and *O. piliferum* [or *C. pilifera*] and *O.* [or *C.*] *coerulescens* on pine and spruce; *O.* [or *C.*] *piceae* (conidial stage *G. penicillioides*) occurs on spruce, pine, oak, and fir; *L. serpens* n.comb. (syn. *Scopularia serpens*) has been found on the wood of a pine killed by the bark beetle *M. piniperda*.

DOUDINA (Mme V. S.). Голландская болезнь ильмовых пород **(Graphium ulmi Schw.)** [The Dutch disease of Elms (*Graphium ulmi* Schw.)].—47 pp., 23 figs., Госуд. Издат. колх.–совх. Литер. „Сельхозгиз" [State Publ. Off. Lit. collect. co-op. Farming 'Selkhozgiz'], Moscow, 1938.

An account is given of the symptoms, world distribution, and control

of the Dutch disease of elms, the cultural characteristics of its agent *Graphium* [*Ceratostomella*] *ulmi* [*R.A.M.*, xviii, p. 282], and the relative resistance to the disease of various species of *Ulmus*.

In U.S.S.R. the disease was first investigated in 1936 and so far has been found in the Ukraine, in Moldavia, and in the Krasnodar and Saratoff districts. In Saratoff 3,500 trees were felled as a result of a severe attack in 1937. Pure cultures of *C. ulmi* were isolated from diseased samples from several districts. It is pointed out that *U. pumila* and *U. pinnato-ramosa*, recorded as resistant by workers in other countries, are widely distributed in Russian Central Asia and could serve as substitutes for the susceptible varieties.

SEELER (E. V.). **Thyronectria denigrata (Winter) Seaver, the cause of disease in Gleditsia.**—*J. Arnold Arbor.*, xx, 1, pp. 114–115, 1939.

The author states that isolations from diseased tissues and inoculation experiments proved that the sudden wilting, followed by death, of three *Gleditsia* [*Gleditschia*] *japonica* trees in the Arnold Arboretum, was caused by *Thyronectria* (*Pleonectria*) *denigrata*, a fungus which had been considered hitherto as only a saprophyte. Further investigation indicated that cankers which developed on many *G. triacanthos* trees on Nantucket Island, following severe winters, were also caused by *T. denigrata*.

HIRANE (S.). **Studies on the parasitism of the rust of Acacia confusa Merrill, Maravalia hyalospora (Saw.) Diet. II. Effects of the juice of phyllodes on the germination and germ-tube development of urediospores.**—*Trans. nat. Hist. Soc. Formosa*, xxviii, pp. 421–430, 1938; xxix, pp. 13–21, 2 figs., 1939.

Pursuing his studies on the parasitism of *Maravalia hyalospora* on *Acacia confusa* [*R.A.M.*, xvi, p. 717], the writer found that the uredospores of the rust germinate neither in distilled nor in tap water, but solely in an infusion or in the expressed juice of young phyllodes at dilutions of 1 in 1,000 (occasionally 1 in 10,000) and 1 in 10,000 to 1 in 100,000, respectively. The substance responsible for the germination of the uredospores was detected in the water placed on young, growing phyllodes, but in no case on mature ones, so that its occurrence would appear to be correlated with a state of active development. The expressed juice further contains a substance exerting an inhibitory effect on uredospore germination, particularly at high concentrations. The repressive effect was most pronounced in the juice of mature phyllodes, which are immune from the disease in nature, but was also apparent in that of the immune or highly resistant uppermost phyllodes and (to a very limited degree) in the juice of the susceptible young ones. Uredospore germination was likewise inhibited by a substance excreted from glands situated on the lower edge of the phyllode. The reaction of the phyllodes to *M. hyalospora* in nature is considered from these observations to depend largely on the influence of the substance inducing uredospore germination.

DE MESA (A.). **Camagon and its pests.**—*Philipp. J. For.*, i. 4, pp. 371–381, 3 pl., 1938. [Received March, 1939.]

Camagon (*Diospyros discolor*), which is stated to be one of the most

valuable Philippine woods for furniture-making and similar purposes, has been found liable to seed infection by *Schizophyllum commune* [*R.A.M.*, xviii, p. 360], invasion of the young trees through broken branch stubs by a species of *Irpex*, and root and bud rots of mature and over-mature trees by *Ganoderma applanatum*. *S. commune*, which completely suppressed germination, may be combated by light sprinkling of the seeds with formalin (37 to 40 per cent.) diluted to half-strength, the seeds being left covered for at least four hours following treatment. Trees severely infected by *G. applanatum* should be felled and the sound wood used immediately.

Důležitější a pozoruhodnější poškození, choroby a škůdci lesních dřevin v r. 1937–1938 v Československu, včetně území soused. státům odstoupených. [The most important and noteworthy injuries, diseases, and pests of forest trees in 1937–1938 in Czechoslovakia, including the districts ceded to neighbouring States.]—*Ochr. Rost.*, xv, 2, pp. 26–33, 1939. [German summary.]

In this list of diseases of forest trees the following are of interest: *Thelephora laciniata* [*R.A.M.*, xvii, p. 567] on *Picea excelsa* [*P. abies*] in nurseries; *Hypodermella sulcigena* [ibid., xvii, p. 570] and *T. laciniata* on *Pinus sylvestris*; *Cenangium abietis* on *Pinus austriaca* [ibid., xiv, p. 476]; *H. sulcigena* on *Pinus montana*; *Pucciniastrum epilobii* [ibid., xvii, p. 571] on *Abies alba*; *Phomopsis pseudotsugae* and *Rhabdocline pseudotsugae* [see next abstract] on *Pseudotsuga douglasii* [*P. taxifolia*]; and *Bacterium* [*Pseudomonas*] *savastanoi* on ash [ibid., xvi, p. 216].

Kalandra (A.). **První výskyt sypavky Duglasky—působené houbou Rhabdocline pseudotsugae Syd.—v odstoupeném Sudetském Území Čech.** [First occurrence of needle-fall of Douglas Fir—caused by the fungus *Rhabdocline pseudotsugae* Syd.—in ceded Sudetenland.] —*Ochr. Rost.*, xv, 2, pp. 36–40, 7 figs., 1939. [German summary.]

The needle-fall of Douglas fir, caused by *Rhabdocline pseudotsugae* [*R.A.M.*, xviii, p. 3], was observed in the spring of 1938 for the first time in Czechoslovakia on three fairly small stands of 30- to 40-year-old trees near Marienbad. The severity of the infection varied with individual trees, some of the crowns being rather badly defoliated. None of the trees has so far been killed.

Thomas (E. A.). **Über die Schweizer Douglasienschütte.** [On the Swiss needle-fall of Douglas Firs.]—*Schweiz. Z. Forstw.*, xl, 2, pp. 55–62, 1 fig., 1939.

Most of the literature on the Swiss needle-fall [*Phaeocryptopus gaeumanni*] of Douglas firs [*Pseudotsuga taxifolia*: *R.A.M.*, xviii, p. 425] here briefly summarized and discussed has already been noticed from time to time in this *Review*. Mention may be made, however, of an oral statement by H. Bürger to the effect that old trees (51 and 55 years) in two cantons of Switzerland have been observed to suffer from the disease, hitherto believed to be restricted to the under 40 age group, in a virulent form.

LUDBROOK (W. V.). **Needle fusion of Pinus in southern New South Wales. Second progress report (1937–38).**—*Pamphl. Coun. sci. industr. Res. Aust.* 89, 20 pp., 1939.

In further work on needle fusion in *Pinus* spp. in New South Wales [*R.A.M.*, xvii, p. 149; xviii, p. 283] the author failed to transmit the disease by grafting. The diseased scions grafted on healthy stocks either died or produced healthy new growth during the first or second season after grafting, and healthy scions on diseased stocks remained healthy during two seasons' growth. The continuous eradication of diseased trees from plots of five species of *Pinus* during four successive seasons had no real effect on the incidence of the disease in the remaining trees. In plots of *P. muricata*, *P. ponderosa*, *P. radiata*, and, when growing under favourable conditions, of *P. caribaea*, the percentage of diseased trees increased not at all or only slightly after a certain age, varying from three to eight years after planting out; in plots of *P. taeda*, which was more severely affected by the disease than any other species, the percentage of diseased trees increased up to at least ten years of age. Except in *P. muricata*, severely affected trees were much less numerous than those only slightly affected, the latter being often observed to recover. It is considered possible that the mild and the severe forms are two distinct diseases, needle fusion being a symptom common to both.

Heavy annual dressings of calcium superphosphate, either alone or in combination with nitrate of soda and sulphate of potash, led to complete or partial recovery of six out of 27 diseased *P. muricata* after one to three years, four of the six showing an increased vigour of growth. During the same period four out of 78 controls also showed signs of recovery. Treatment with borax or boric acid resulted after one to two years in complete or partial recovery of 14 out of 52 diseased *P. muricata* as compared with 27 out of 221 controls, but was not followed by increased vigour of growth. *P. ponderosa* and *P. radiata* did not respond to treatment with boron compounds. Spectrographic examinations of healthy and diseased needles revealed a marked deficiency of silver in diseased samples, but treatment with silver compounds gave negative results. Treatment with other chemicals, and also pruning, thinning, or top-dressing with farmyard manure failed to control the disease. Under present conditions the disease is not considered to be of economic importance in southern New South Wales to any of the *Pinus* spp. except *P. taeda* and possibly *P. caribaea* in coastal areas.

FAULL (J. H.). **A review and extension of our knowledge of Calyptospora goeppertiana Kuehn.**—*J. Arnold Arbor.*, xx, 1, pp. 104–113, 1939.

In giving a brief review of the literature dealing with *Calyptospora goeppertiana* [*R.A.M.*, xii, p. 666], the author states that the fungus has been experimentally shown to be able to infect 13 species of *Abies*, no species of which is known to be immune from the fungus. Details are then given of life-history studies, in which *A. balsamea* was successfully infected with teleutospores from *Vaccinium pennsylvanicum* and *V. canadense*. A comparative study of *C. goeppertiana* [the results of which are tabulated] with *Peridermium ornamentale* and *P. holwayi*, which are held by Arthur [ibid., xiii, p. 728] to be synonymous with the

first-named, indicated that the last two are probably distinct from one another and that neither is identical with *C. goeppertiana*. Should further studies demonstrate the existence of diploid phases of *P. ornamentale* and *P. holwayi* referable to the genus *Calyptospora*, then the existing collections of *C. goeppertiana* from western North America should be subjected to revision. The paper terminates with a list of the specimens of *C. goeppertiana* which were studied by the author, showing that the rust is present in Germany and Japan as well as several parts of Canada and the United States. *V. vitis-idaea* var. *minus* is included as a new host.

WAGENER (W. W.). **The canker of Cupressus induced by Coryneum cardinale n.sp.**—*J. agric. Res.*, lviii, 1, pp. 1–46, 8 figs., 1 graph, 1 map, 1939.

This is a full report of the author's studies of the bark canker of *Cupressus macrocarpa* and *C. sempervirens stricta* in California, including a description [with a Latin diagnosis] of the causal fungus, named *Coryneum cardinale* [not *C. cardinalis*: *R.A.M.*, xviii, p. 149]. In California the canker is estimated to have killed up to date about 30,000 trees of the two species, and in many districts discourages their further cultivation; it has been found sporadically on *C. pygmaea*, *C. lusitanica*, *C. forbesii*, *Thuja orientalis*, *Libocedrus decurrens*, and *Juniperus*. The disease is also known to occur in the North Island of New Zealand. The most conspicuous symptom of the disease is the fading and death of individual twigs, branches, or tops of affected trees, most frequently in spring at about the time when the host begins normally to grow rapidly, though it may also occur throughout the year. Under favourable moisture conditions fruiting bodies of *C. cardinale* are produced on killed bark; they appear as small, scattered, black, subepidermal or partially immersed acervuli, at first closed, later erumpent and opening widely; they are irregularly circular, oblong, or lenticular in outline, and 0·3 to 1·5 mm. in diameter; the sporogenous margins are frequently persistent after opening and often reflexed. The stromatic layer is often loculate or semiloculate, up to 300 μ thick, subhyaline to light olivaceous. The conidia are oblong-fusoid, 5-septate, 21 to 26 (18 to 33·5 μ) by 8 to 10·5 μ (7·5 to 12 μ), the four median cells concolorous, olive-brown, 16·5 to 18·5 μ (14 to 20 μ), not or slightly constricted at the septa, end cells muticately short-conic to occasionally long-conic, hyaline. The conidiophores are simple or branched, 15 to 55 by 1·4 to 2·2 μ, and the pseudoparaphyses are filiform, somewhat sinuous, 40 to 60 by 1 to 1·5 μ. In nature spore production is governed chiefly by humidity, and field evidence and tests on material stored indoors indicated that the conidia are relatively long-lived. Field dissemination appears to occur chiefly through the agency of wind and rain, but the disease has also been spread on nursery stock and locally by means of pruning tools, and birds and insects are suspect. Localization of the disease appears to be the most promising method of control.

COLLEARY (M. J.). **The treatment of fence-posts with preservatives.**—*Circ. For. Serv. Can.* 56, 17 pp., 2 figs., 1939.

This is a comprehensive account of the treatment of fence posts with

preservatives by means of a brush, by dipping, steeping, and by the hot and cold open-tank method. Using creosote, the estimated increase in life by the brush, dipping, and hot and cold treatments is 2 to 3, 2 to 4, and 15 to 20 or more years, respectively. Zinc chloride and sodium fluoride applied by the hot and cold tank method both gave a life increase of 10 to 15 years. Treatment with creosote by the hot and cold tank method cost for materials from 10 to 40 cents per post and with zinc chloride 6 cents. Permissible expenditures for treatment are discussed but it is not practicable to give a general cost figure covering all operations.

Gäumann (E.). **Über die Wachstums- und Zerstörungsintensität von Polyporus vaporarius und von Schizophyllum commune bei verschiedenen Temperaturen.** [On the intensity of growth and destructive activity of *Polyporus vaporarius* and *Schizophyllum commune* at different temperatures.]—*Angew. Bot.*, xxi, 1, pp. 59–69, 3 graphs, 1939.

In cultural experiments with the wood-rotting fungi *Polyporus vaporarius* [*Poria vaporaria*: *R.A.M.*, xvii, p. 786] and *Schizophyllum commune* [see above, p. 490] the optimum temperatures for vegetative growth (as determined by measurements of the diameters of the colonies) were found to be 26·7° and 33·1° C., respectively, while the biological activity of the two fungi (calculated from the amounts of wood substance rotted or the loss in weight of the wood) was greatest at 24° and 30·1°, respectively, the optimum temperature being in both cases 2° to 3° lower than that for growth.

Raabe (A.). **Untersuchungen über pilzparasitäre Krankheiten von Raps und Rübsen.** [Investigations on parasitic fungal diseases of Colza and Rape.]—*Zbl. Bakt.*, Abt. 2, c, 1–3, pp. 35–52, 9 figs., 1939.

The writer has investigated the fungal pathogens of colza (*Brassica napus* var. *arvensis*) [*B. campestris* var. *oleifera*] and rape (*B. rapa* var. *silvestris*) [*B. napus* var. *oleifera*] in Germany [*R.A.M.*, xvii, p. 717] with a view to ascertaining their modes of infection and economic importance. *Alternaria brassicae* (Berk.) Bolle, to which rape is more susceptible than colza, was shown to be capable of attacking seedlings of both species under very humid conditions, but in practice the necessary degree of atmospheric moisture is seldom likely to prevail at this stage in the development of the crops. The fungus is not seed-borne, infection being perpetuated by conidia produced in the early summer on overwintered plant debris.

In inoculation experiments with various strains of *Rhizoctonia* (*Hypochnus*) [*Corticium*] *solani*, H. Schultz's var. *typica* [ibid., xvii, p. 184] from potato, which has been found in nature on colza roots [ibid., xi, p. 95], caused no damage beyond mechanical interference with normal activity; the same worker's var. *brassicae* was severely pathogenic to young plants both of colza and rape. Pending further studies on the relationship between the *C.* strains on potato and the oleaginous crucifers these crops should not be grown in rotational sequence.

No physiological differences could be detected between the hemp and

colza strains of *Sclerotinia sclerotiorum* [ibid., xvii, pp. 217, 717], and the mycelium and ascospores of a hemp strain readily infected colza. *Botrytis cinerea* may be a source of severe damage to colza under unfavourable environmental or cultural conditions, rotting the stem bases and covering them with a dense, grey coating. The general aspect of plants attacked by *S. sclerotiorum* or *B. cinerea* is very similar. No importance need be attached to the occasional development on colza of *Erysiphe communis* and *Peronospora brassicae* [*P. parasitica*]. A species of *Typhula*, with spherical or reniform sclerotia, 1 to 2 mm. in diameter, is prevalent in the spring on colza leaf remnants in an advanced stage of decay, and has also been observed in the writer's experimental plots on sickly young plants dying from collapse of the stems and heart shoots. Possibly the fungus may play a part in the complex of symptoms collectively known as 'winter injury'. *Phoma lingam*, which has recently assumed a serious form on cabbage in parts of Germany [ibid., xv, p. 335], has been reported from New Zealand on colza [ibid., xiii, p. 71], and experiments with this fungus have accordingly been initiated at the Biological Institute.

LECLERG (E. L.). **Studies on a cultural variant of Rhizoctonia solani.**—*Phytopathology*, xxix, 3, pp. 267–274, 3 figs., 1939.

Details are given of the writer's studies at the Louisiana Agricultural Experiment Station on the physiology, morphology, and pathogenicity of a sector variant of *Rhizoctonia* [*Corticium*] *solani* from sugar beet on various media [*R.A.M.*, xvii, p. 498]. The variant grew less rapidly than the parent culture on potato dextrose, dextrose, and methylene blue media, but much faster on substrata of high-, medium-, and low-nitrogen composition. On media containing varying amounts of sucrose, the parent grew more rapidly at 0, 1, and 5, and the variant at 10 and 20 per cent. sucrose. At 15°, 23° to 25°, and 29° to 30° C. the radial growth of the variant was less than that of the parent. The mutant was less aggressive than the parent in the decay of large sugar beet roots (average of 8·5 as against 33·2 per cent. volume of rot), but caused more damping-off at soil temperatures of 15° and 25° (100 per cent. at both compared with 73·4 and 69·4, respectively).

Вредители Сахарной Свеклы и меры борьбы с ними. [Diseases of the Sugar Beet and measures for their control.]—ex *Свекловодство* [*Sugar Beet Industry*], iii, pp. 203–392, 77 figs., 2 graphs, Гос. Издат. колхоз.-совхозн. Лит. УССР [State Publ. Off. Lit. coll. co-op. Fmg Ukr.S.S.R.], Kharkoff [? 1938: Received April, 1939].

This compilation is the work of V. P. Muravyeff, Mme N. I. Salunskaya, and S. F. Morotchkovski, under the general editorship of M. P. Panassyuk. The authors give a general account of the diseases of sugar beet throughout the world, with particular stress on those that occur in the U.S.S.R., incorporating the results of recent researches. Control measures, including breeding for resistance, are dealt with in detail. A dichotomous key for the identification of the diseases by their external symptoms is appended, together with a full list of the Latin names of the parasitic organisms concerned.

CROSIER (W.) & PATRICK (S.). **Chemical elimination of saprophytes during laboratory germination of seed Peas.**—*J. agric. Res.*, lviii, 6, pp. 397–422, 1939.

In tests with various seed disinfectants for inhibiting the growth of saprophytes on germinating pea seeds [cf. *R.A.M.*, xvii, p. 644], both seeds and seedlings were effectively protected from the seed-borne *Rhizopus nigricans*, *Penicillium* spp., and *Dematium* [*Pullularia*] *pullulans* by 0·18 per cent. new ceresan, 0·20 per cent. mercuric chloride, or 1·5 per cent. ceresan dip. Other mercury compounds were nearly as efficient, whereas copper and zinc compounds protected the seeds but not the seedlings. *Alternaria* spp., *Rhizoctonia* [*Corticium*] *solani*, and *Fusarium* spp. were not controlled by any seed treatment. The radicles of ceresan-treated peas were longer and the green weights of the sprouts greater than those of the untreated peas. A dust containing 80 per cent. copper stearate, 16 per cent. diluent, and 4 per cent. new ceresan completely disinfected 30 varieties of peas.

ARTEMIEVA (Mme Z. S.). Возбудители некоторых бактериозов фасоли. [The causal organisms of some bacterial diseases of French Beans].—*Микробиол.* [*Microbiol.*], vii, 7, pp. 899–911, 1938. [Received April, 1939.]

Cultures of *Bacterium medicaginis* var. *phaseolicola* [*R.A.M.*, xviii, p. 366] and *Bact. puerariae* [regarded by Burgwitz as a synonym of the former: ibid., xv, p. 4] isolated in Moscow from seeds and from pods and leaves of French beans [*Phaseolus vulgaris*], respectively, were compared with each other and with a bacterium also isolated from seeds of the French bean, which seemed to occupy an intermediate position between the two species. It is believed that all three forms are closely related and are able under natural conditions to pass from one into the other by losing or acquiring certain biochemical properties. Thus, a strain isolated from a plant artificially infected with *Bact. puerariae*, was found to have lost the capacity to peptonize milk, typical for *Bact. puerariae*, while it was able to liquefy gelatine, a property characteristic of *Bact. medicaginis* var. *phaseolicola*. Antisera of *Bact. mori* [ibid., xvii, p. 799; xviii, p. 158] were able to agglutinize *Bact. medicaginis* var. *phaseolicola* and *Bact. puerariae* as well as *Bact. mori*, and vice versa. The acid-producing strains of *Bact. mori* are considered to be a link between the alkali-producing strains of *Bact. mori* and *Bact. medicaginis* var. *phaseolicola*. In cross-inoculation experiments *Bact. medicaginis* var. *phaseolicola* and *Bact. puerariae* were able to infect beans but not mulberry, while *Bact. mori* infected mulberry but not beans. Strains 216, 285, and 3040 of *Bact. medicaginis* var. *phaseolicola* received from Rostoff differed from the other strains of this bacterium in their serological and biochemical properties and produced no infection on either French beans or mulberry.

Bact. phaseoli var. *fuscans* [ibid., xvi, p. 85] was also isolated from French beans. It is considered to be rather unstable in its biochemical properties, showing great variation in its reactions to milk and gelatine. Some strains of this bacterium, designated *β*, which are generally non-pigmenting, produced pigment on media with tyrosine, and strains 100

and 102 did not pigment at first but began to produce pigment after a month.

DIPPENAAR (B. J.). **Diseases of Lettuce. I. Macrosporium leaf spot.**—*Fmg S. Afr.*, xiv, 156, pp. 101–103, 106, 3 figs., 1939.

A popular description is given of the leaf spot of lettuce in the Cape Flats district of South Africa caused by *Macrosporium sarcinula* [*Stemphylium botryosum*: *R.A.M.*, xviii, p. 141] (the perfect stage of which, *Pleospora herbarum* [ibid., x, p. 430], has not yet been observed in the field though it readily develops on standard media in the laboratory), supplemented by full directions for its control by repeated applications of standard sprays (verderame 5 lb., ortho spreader ½ lb., 100 gals. water, or Bordeaux mixture 4–6–100 plus ortho) or dusts (verderame, copper-lime 1 : 4, or folosan).

WATANABE (T.). **On the anatomy of Sweet Potatoes affected by the stem rot fungus.**—Reprinted from *J. agric. Res. Soc. Utsonomiya agric. Coll., 1939*, 14, 11 pp., 2 pl., 1939. [Japanese, with English summary.]

Observations on sweet potato plants of the Kawagoe-Beniaka variety infected by stem rot (*Fusarium*) [? *bulbigenum* var. *batatas* and *F. oxysporum* f. 2: cf. *R.A.M.*, xiii, p. 123; xvii, p. 658] showed that the fungus is capable of inducing a splitting and brown discoloration of the stem when introduced through deep longitudinal cuts. The phloem and cambium were most accessible to penetration, followed by the xylem, medullary rays, and pericycle, while the starch sheath and pith were also slightly involved. The superficial inoculation of uninjured stems gave negative results. Generally speaking, the symptoms of stem rot were relatively mild in artificially infected plants, which succumbed only under conditions exceptionally favourable to the fungus. In cases of natural infection invasion proceeded rapidly through the vessels and contiguous tissues, the mycelium being detected at distances of up to 80 cm. from the end of the fissure and vascular discoloration and tyloses even farther from the site of entry. The externally sound storage roots of diseased plants were found to show similar evidence of permeation by the fungus.

Destructive Insect and Pest Acts, England. The Fruit Tree Pests (Norfolk) Order of 1939. Dated February 10, 1939. No. 164 of 1939.—4 pp., 1939.

This Order, effective as from 1st March, 1939, and concerned with the control of fungal diseases of fruit trees in Norfolk (exclusive of the Borough of King's Lynn or the County Borough of Great Yarmouth), is on similar lines to those previously issued to other local authorities [*R.A.M.*, xvi, p. 576].

Service and regulatory announcements. October–December, 1938.—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 137, pp. 142–153, 1939.

Summaries are given of the plant quarantine import restrictions in force in Switzerland, Argentina (supplementary), Australia (supplementary), and the French Regency of Tunisia.

IMPERIAL MYCOLOGICAL INSTITUTE

REVIEW OF APPLIED MYCOLOGY

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HEDGES (FLORENCE). **Bean bacterial wilt.**—*Leafl. U.S. Dep. Agric.* 174, 5 pp., 7 figs., 1939.

Bacterial wilt (*Bacterium flaccumfaciens*) of beans [*Phaseolus vulgaris: R.A.M.*, xv, p. 463; xvii, pp. 799, 810] is stated in this popular account to have been reported from Maryland, Michigan, Montana, North and South Dakota, Oregon, Wyoming, and West Virginia, as well as from Canada, France, Germany, Belgium, Bulgaria, and Australia. Infected seed is the sole known agent of dissemination of the disease, the control of which should be based on stringent selection of sound material for sowing. Fields should be examined both early and late during the growing season, and only those with a minimum of disease used as sources of seed supply. The risk of transmission through the seed may be still further reduced by careful hand-picking of the seed, excellent results from which have been obtained for several years past by a progressive Michigan firm.

TOMPKINS (C. M.), ARK (P. A.), TUCKER (C. M.), & MIDDLETON (J. T.). **Soft rot of Pumpkin and Watermelon fruits caused by Pythium ultimum.**—*J. agric. Res.*, lviii, 6, pp. 461–475, 3 figs., 1939.

Pythium ultimum was found to be associated with a soft rot of Zucchini and Mammoth Summer Crookneck pumpkin (*Cucurbita pepo* var. *condensa*) and Klondyke watermelon fruits in California. Fruits of any size and age become infected when in contact with wet soil, and develop soft, sunken, water-soaked lesions, which grow rapidly and cause the collapse of the underlying tissue. In advanced stages the lesions are frequently covered with closely adpressed, white mycelium. The fruits may be completely rotted six to ten days after the appearance of the first symptoms of infection, and such fruits break open on handling. The disease is favoured by cool weather. The causal fungus was readily obtained in culture; some of the isolates did not produce oospores (as a result, it is believed, of the failure of the organism to produce antheridia) but developed, instead, reproductive bodies resembling oogonia. The relation of temperature to the growth of the mycelium was the same in all cucurbit isolates and in those from lucerne, tobacco, spinach, and an unknown host, the optimum being 25° to 28°, the minimum 4°, and the maximum 40° C. All these isolates caused damping-off of pumpkin, watermelon, and tomato seedlings during the pre-emergence and small-seedling stages of growth. Inoculation of uninjured pumpkin fruits in the laboratory was successful but

in watermelons the infection occurred only after wounding. Infection was also obtained in unwounded fruits of green and ripe tomato, bean (*Phaseolus vulgaris*), eggplant, and field pumpkin (*C. pepo*), but wounding was necessary for the infection of the fruits of the apple, bell pepper (*Capsicum annuum*), various cucurbits, lemon, and orange, the roots of turnip, rutabaga, carrot, and parsnip, potato tubers, onion bulbs, and sweet potatoes.

Borzini (G.). **Una particolare malattia della Vite.** [An unusual Vine disease.]—*Boll. Staz. Pat. veg. Roma*, N.S., xviii, 3, pp. 342–359, 9 figs., 1 graph, 1938 (issued 1939).

In July, 1937, vines in Tripoli developed a condition characterized by the presence of 30 to 40 round or irregular spots, 2 to 3 mm. in diameter, on both leaf surfaces. These spots showed a dried-up central part bearing dark tufts of conidiophores of a species of *Alternaria* and had a blackish rim.

In inoculation experiments in Rome by spraying vines with a suspension of the spores of the fungus, typical spotting developed after two days. The simple, brown-olivaceous, sparsely septate conidiophores measured 80 to 110 (average 87·4) by 2·8 to 3·4 (3·15) μ and were rounded at the extremities. The ovoid, elongated, brown-olivaceous conidia measured 9·4 to 34·5 (average 20·65) μ—excluding the beak (2·28 to 11·5 (2·48) μ long) shown by about 50 per cent. of them—by 5·1 to 11·5 (8·5) μ. They showed 1 to 4 (average 2·29 septa), about 30 per cent. having oblique or longitudinal septa, and were borne in single chains (occasionally two chains to a conidiophore) of one to five.

The fungus differs distinctly from *A. vitis*, *A. viticola*, *Macrosporium velutinum*, and *M. vitis*, previously recorded on vine, but is close to *A. tenuis*; a more precise identification, however, is not possible until the fungi in this group have been studied in greater detail.

Du Plessis (S. J.). **Bacterial blight in Vines.**—*Fmg S. Afr.*, xiv, 155, pp. 55–59, 4 figs., 1939.

Bacterial blight of vines, originally reported by Ravaz from the Île d'Oléron, off the west coast of France [and attributed to *Bacillus vitivorus*: *R.A.M.*, xvi, p. 229], was first observed in South Africa on the Canaan variety in 1936. It causes the formation of cracks on one or both sides of the young shoots and a dark blackish-brown discoloration of the surrounding tissues, sometimes spreading to the leaves, and also involving the bunches. Primary infection of the foliage results in the development of numerous dark brown spots, usually surrounded by a pale yellow border; in severe cases the sound tissues turn ruddy brown and impart a characteristic flame-like appearance to the vines. Later in the season the spots on the shoots change to a tawny colour and the fissures widen, sometimes exposing the pith, while during the autumn black dots, the fruit bodies of saprophytic fungi, are produced on the tawny-white lesions. The causal organism appears to overwinter in the vines, infecting the new shoots through abrasions and the leaves through the undamaged surface. The disease is spread by the use of infected knives, as well as by means of blighted scions. The most susceptible varieties are Canaan, Santa Currant, and Sultana, while

Raisin Blanc, Barbarossa, Riesling, and others have shown some degree of resistance. Full directions are given for the control of the disease by stringent sanitary measures supplemented by the application of verderame, copper sulphate, or Bordeaux mixture immediately after the topping of the vineyard.

Gračanin (M.). **Kloroza Vinove Loze na otoku Visu.** [Chlorosis of Vine on the island of Vis.]—*Ann. Trav. agric. sci., Belgrade,* v, 13, pp. 3–14, 5 figs., 1938. [German summary. Received May, 1939.]

On the island of Vis, Yugoslavia, vines growing on soils rich in iron were found to suffer from a typical iron deficiency chlorosis [*R.A.M.*, xvii, p. 792]. Investigations showed that chlorosis developed on soils containing much calcium carbonate, particularly in a finely dispersed form, but not on those containing small amounts. Since the assimilation of iron by the roots is arrested by the presence of calcium carbonate in the soil, spraying the leaves with a 0·2 per cent. solution of iron sulphate, applied preferably on cloudy days or in the evening, is recommended for control, as well as manuring with stable manure and with acid fertilizers, such as ammonium sulphate, in order to render iron available. Sites for new vineyards should be examined with reference to the calcium carbonate content of the soil.

Vidal (J. L.). **Rôle de la transpiration et de l'anhydride carbonique dans l'étiologie de la chlorose calcaire.** [The part played by transpiration and carbon dioxide in the etiology of lime-induced chlorosis.]—*C. R. Acad. Sci., Paris,* ccviii, 1, pp. 47–49, 1939.

Continuing his studies on lime-induced chlorosis of the vine [*R.A.M.*, xvii, p. 291 and preceding abstract] the author gives a brief account of experiments, the results of which showed that intense transpiration is an important factor in the development of the disease, as well as the presence in the soil of carbon dioxide; the effect of the latter is to facilitate the solution of calcium carbonate, which in its turn renders insoluble the iron present in the soil. [An account of this work is also given in *Rev. Vitic., Paris,* xc, 2334, pp. 239–241, 1939.]

Padwick (G. W.). **Report of the Imperial Mycologist.**—*Sci. Rep. agric. Res. Inst., New Delhi, 1937–38,* pp. 105–112, 1939.

This report on plant disease work in India in 1937–8 [cf. *R.A.M.*, xvi, p. 515] contains the following items of interest, apart from those already noticed from other sources. Two years' freedom from wheat considerably reduced soil infection by *Tilletia indica* [ibid., xvii, p. 21]. Plots given excess irrigation developed more infection than others (1·5 and up to 0·5 per cent. in two plots, as against no infection, on P. 165 wheat), confirming the view that moisture plays an important part in the incidence of the disease.

When non-viruliferous white flies [?*Bemisia gossypiperda*] were fed on juice from a leaf curl tobacco plant and placed on about 110 tobacco seedlings raised in an insect-proof cage, two of the plants developed distinct symptoms of a mixed type of leaf curl, and five slight vein-clearing [ibid., xvii, p. 75].

In periodical isolations from wilted gram [*Cicer arietinum*] plants a number of isolates of *Fusarium* [ibid., xvi, p. 151] were obtained, one type being predominant in all. All the types were grown in flasks in a sterilized mixture of dry soil, maize meal, and water, and after three weeks the mixture was applied to a sterilized soil in layers above and below gram seed. In some cases the plants grew as well as the uninoculated controls, in others the seed failed to germinate, while in the case of the type most generally isolated all the inoculated plants wilted and died before they were six weeks old. The original fungus was invariably isolated from the dead plants.

The chief cause of a leaf spotting of *Hevea* rubber in the Mundakayam Valley was determined as *Oidium heveae*.

Further investigations into apple infection by *Rhizopus arrhizus* [ibid., xvii, p. 47, 796] demonstrated that slight decay occurred even at 15° C.; at temperatures of 30° or more the destructive effect on the fruit was well marked. In culture, the best growth occurred at P_H 4·1 to 4·4.

The reduction in yield caused by mosaic in the thick sugar-cane variety Surkha Saharanpuri amounted to 18·8 per cent. [cf. ibid., xvi, p. 232]. Recovery from mosaic in Co. 313 canes, reported from Pusa, was not observed at Shahjahanpur. When mosaic-affected Co. 313 material from Pusa and Shahjahanpur was tested for recovery at Pusa, Delhi, and Karnal, the former was found to show 15 to 20 per cent. recovery, whereas the latter showed none. This result supports the view that the virus strain affecting Co. 313 at Shahjahanpur is different from that attacking the same variety at Pusa. Inoculations with juice from the leaves of recovered plants of Co. 213, 313, 223, 299, and 419 canes gave no infection during the year, indicating that the recovery in question is real and not the result of masking.

Dilution tests (using maize as test plants) with leaf juice from mosaic M–16, Surkha Saharanpuri, Co. 213, and Co. 313 canes demonstrated that the juices of M–16 and Surkha Saharanpuri resisted dilution better than that of Co. 313, which in turn withstood it better than that of Co. 213. Mosaic juices from several varieties were centrifuged for half an hour at 3,000 r.p.m. with no appreciable reduction of virulence in the supernatant liquid.

A careful investigation was made of the 'cyclostage' organisms [ibid., xv, p. 315] reported to have been isolated from mosaic canes, but all attempts to repeat the work on the filterability of these bodies through an L_3 Chamberland filter candle failed. It was then ascertained that different methods of testing the candles result in the selection of different grades, and this may account for the different results obtained at various times with regard to filterability of organisms.

Considerable damage to sugar-cane foliage, particularly on thick varieties, was caused at Jorhat (Assam) Farm by *Cercospora kopkei* [ibid., xv, p. 346], not previously reported from India, though found in Burma.

Cultures of the fungus commonly known as *Cephalosporium sacchari* [ibid., xvi, p. 774] were identified at Baarn as *Fusarium moniliforme* var. *subglutinans* (= *Gibberella fujikuroi*) [var. *subglutinans*].

The leaves, twigs, and fruits of chilli plants [*Capsicum annuum*] near

Delhi were observed by Mitra and K. M. Dutt to show greyish or greyish-brown, oval, roundish or irregular spots with concentric rings, produced by an *Alternaria*. The pathogenicity of the fungus was established.

Mango twigs from Bengal were infected by *Dimerosporium mangiferum*. Inside, the wood was ash-grey and contained a black mycelium. On incubation in a moist chamber numerous dark pycnidia appeared on the tissue, with dark, bicellular, striate spores resembling those of *Diplodia natalensis*.

In the course of an examination of species of *Fusarium* on pigeon pea (*Cajanus cajan*), sann-hemp (*Crotalaria juncea*), cotton, *Cicer arietinum*, and other plants, Mehta and the author isolated from wilted pigeon peas several distinct species, one of which appeared to differ from *F. udum* [ibid., xvii, p. 652] and to produce severe wilting but no foot rot. The identity of this fungus is being established.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, 1, 3, pp. 157–61, 4 figs., 1939.

Zinnia plantings are reported to have suffered serious losses in various parts of New South Wales from a wilt and root rot disease, for which *Rhizoctonia* [*Corticium*] *solani* was mainly responsible. The hot, dry season is believed to have predisposed the plants to infection. Serious outbreaks occurred on land not previously cropped for eight to ten years. Formalin treatment of the soil in seed-beds and of utensils is recommended for the control of the disease.

All the locally grown commercial varieties of peas are stated to be suceptible in a varying degree to bacterial blight (*Bacterium* [*Pseudomonas*] *pisi*) [*R.A.M.*, xviii, p. 217]. Control measures should include the use of clean seed (although it is not easy to recognize it as such by the external appearance) and the adoption of plant sanitation methods, such as the destruction by burning of diseased plants. Seed disinfection is of limited value, as the disease is carried both inside and outside the seed coat.

Plant Diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, 1, 4, pp. 199–203, 6 figs., 1939.

In these notes it is stated that onion black mould (*Aspergillus niger*) [*R.A.M.*, xiv, p. 553] occurs in New South Wales under field conditions, but serious losses are not as a rule experienced except in bulbs kept for some time in storage. Infection begins on the outer scales and spreads inwards, the inner scales being attacked through the neck of the bulb. A path is thus opened for secondary infections.

Onion smudge (*Colletotrichum circinans*) [loc. cit.] generally occurs as a light infection of the fleshy scales, resulting in a reduction in market value, but if the bulbs are harvested under wet conditions, and not dried properly before being bagged, serious losses may follow, including shrinkage in storage and increased susceptibility to various rots. The disease is almost entirely confined to white varieties. Both smudge and black mould are amenable to control by the removal of all affected bulbs at digging, thorough drying before marketing, storage under cool, dry conditions, crop rotation, and the burning of diseased crop refuse.

SIMMONDS (J. H.). **Report of the Plant Pathological Section.**—*Rep. Dep. Agric. Qd, 1937–38*, pp. 36–9, 1938. [Received May, 1939.]

The following items of interest occur in this report [cf. *R.A.M.*, xvii, p. 376]. Hyperplasia or 'wallaby ear' was very prevalent on late planted maize crops in Southern Queensland. This condition, which is stated to have only rarely reached serious proportions during the last 30 years, is characterized by stunting of the plants, shortened, stiff, erect leaves with the margin incurved, the blade crinkled, and the veins hypertrophied, by reduced or inhibited tassel formation, and sometimes even complete unproductiveness. Heavy rainfall coupled with high humidity and temperature are thought to exert an adverse effect on the growth of young maize plants, resulting in the production of the disease.

F. W. Blackford found *Rhizoctonia* [*Corticium*] *solani* associated with a rotting of tobacco stems [ibid., xvi, p. 841] near ground-level, causing considerable losses in young plants.

Following heavy rains in May serious losses occurred from a severe fruit fall of mandarins (chiefly Emperor of Canton variety) and of matured early oranges. The first symptom was a breakdown of the rind, causing a water-soaked area near the stylar, or less frequently the stem end of the fruit. The trouble is greatly increased when the rainy period is followed by a sudden cold spell. It is considered to arise from the excessive absorption of water by the rind of mature fruit, and consequent liberation of oil, both externally and internally.

Yellow crinkle of papaw [ibid., xvii, p. 259] has remained in a quiescent state since the somewhat serious outbreak in 1937, and where diseased plants were systematically eradicated little further development has been noticed. A new disease of papaw, suspected to be of virus origin, was observed for the first time in one locality and is characterized by an upward bending of the leaf-stalks and an abnormal development of the veins, which are broadened at the expense of the somewhat reduced blade. Serious die-back of papaw [loc. cit.] developed during the late autumn of 1938.

In experiments on the control of little leaf of apple [ibid., xviii, p. 261] promising results were obtained with a spray containing zinc sulphate. Grape anthracnose (*Elsinoe ampelina*) [ibid., xvii, p. 730] was satisfactorily controlled by four or five applications of Bordeaux mixture, commencing at bud burst, while the untreated vines sustained a complete loss. The sulphuric acid-iron sulphate swab proved of little value and is not recommended for inclusion in the spraying programme.

In H. E. Young's fertilizer experiments complete control of the fused needle disease of *Pinus* spp. [ibid., xviii, p. 491] was achieved with some of the treatments, but soil analyses supplied no explanation for these beneficial results. Soil acidification improved the condition, while liming depressed growth; spraying with zinc sulphate gave entirely negative results. Connecting diseased trees by means of a large number of root grafts to healthy trees gave negative results at first but led eventually to a considerable degree of recovery.

Six out of eight introduced mycorrhizal fungi belonging to the genus *Boletus* [cf. ibid., xv, p. 596], used for inoculating sterile *P. caribaea* seedlings, produced a significant increase in plant development as compared with that obtained with the native Queensland mycorrhiza, *B.*

viscidus giving particularly good effects. The causal agent of the leaf cast disease of Kauri pine [*Agathis australis*] was shown by successful inoculations of both *A. palmerstoni* and *A. robusta* to be a species of *Hendersonula*. *Rhizoctonia* root rot of hoop pine [*Araucaria cunninghamii*: ibid., xvi, p. 155] was successfully transmitted by soil inoculation in the glasshouse. The perfect stage of this fungus appears to be *Helicobasidium compactum* [see below, p. 546].

Shirlan AG proved an efficient preventive of moulds in eggs [ibid., xviii, p. 180], both under cold storage and room temperature conditions.

On pp. 40–44 of the same report H. K. Lewcock gives information on pineapple diseases and their control. A soil deficiency disease peculiar to the Caboolture-Beerwah area, called 'crookneck' because of the manner in which the heart leaves twist together and lean to one side, was markedly reduced in young plants by spraying with a solution of boracic acid at monthly intervals. The disease usually appears during the early stages of growth, plants propagated from slips or crowns being much more susceptible to it than those from suckers. A severe and widespread outbreak of marbling [ibid., xiv, p. 216] occurred about the middle of the summer. Field inoculation experiments showed that two, or possibly three, distinct bacteria [unspecified] may cause the disease, the typical symptoms of which were successfully reproduced in pineapple fruits. The disease is usually associated with low sugar content and low acidity. *Penicillium* sp. and *Fusarium* sp. were found to induce the brown speck condition in pineapple fruits, the infected tissue being also frequently invaded by various secondary organisms. The two fungi are relatively weak parasites and infection is determined, among other factors, by weather conditions and the chemical composition of the ripening fuit. Inoculation experiments were for this reason somewhat inconsistent. Black heart of pineapple [ibid., xv, p. 281], a physiological disorder correlated with low temperature conditions and therefore almost entirely restricted to the winter months, was found to be associated with a low sugar concentration in the fruit tissue. The disease occurred to a much greater extent in fruits picked when immature than in those gathered when fully ripe.

THOMPSON (A.). **Notes on plant diseases in 1937–1938.**—*Malay agric. J.*, xxvii, 3, pp. 86–98, 6 figs., 1939.

In addition to *Fomes noxius* and *Ganoderma lucidum* [*R.A.M.*, xvii, p. 314], a third fungus, probably a Polypore, is recorded causing a slowly developing stem rot of oil palms in Malaya. During periods of dry weather *Pestalozzia palmarum* was observed causing greyish-brown lesions, and *Helminthosporium* sp. causing a darker brown, linear leaf spot of oil palms. The latter fungus failed to cause damage in inoculation experiments and is considered a facultative parasite. A curious bending of the petioles of the oldest leaves of mature oil palms [ibid., iv, p. 84] occurred on a peat area, possibly owing to a nutritional disturbance, as the palms had been regularly manured with rock phosphate for some years. Species of *Mucor*, *Fusarium*, *Aspergillus*, and *Trichoderma* were found to develop on oil palm kernels after de-pericarping.

Heart rot has caused steady monthly losses of young pineapple plants in Johore, although not in sufficient numbers to cause alarm. The

symptoms of the disease closely resemble those attributed to *Phytophthora* in Hawaii [ibid., xv, p. 378], but the fungus has not been isolated locally. The results of inoculation experiments indicated that *P. parasitica* and *P. palmivora* can attack the plants under certain conditions.

Red root disease of tea (*Ganoderma pseudoferreum*) [ibid., xvii, p. 202] was observed to cause a rather sudden wilt, killing apparently normal bushes within a week. Infection was frequently traced to a jungle or shade tree stump, the common shade trees *Albizzia* [*moluccana*] and *Gliricidia* [*maculata*] both being susceptible to the fungus. The sudden onset of the disease is attributed to the fact that sometimes only a few of the lateral roots may be affected and the normal functioning of the bush is not disturbed until the fungus has completely encircled the tap-root and penetrated into the cortex. Attempts were made to control the wilt by exposing the upper lateral roots and the tap-root to the air, as the mycelium of the fungus was known not to grow on such roots. The exposure did not harm the bushes, but the method was less safe than trenching.

Ustulina zonata [ibid., xvi, p. 153] is stated to be the most common cause of root disease of tea at Cameron Highlands. At Serdang the disease was invariably associated with old stumps of *Grevillea* [*robusta*] shade trees. Cultural studies definitely proved *Fomes noxius* [ibid., xvi, p. 798] to be the causal fungus of brown root disease of tea, which together with *Rosellinia* root rot [ibid., xvii, p. 202] is fairly common on tea at Cameron Highlands, where they are more important on seed-bearers than on field bushes.

The leaves of durian (*Durio zibethinus*) plants at Serdang were attacked by anthracnose (*Colletotrichum* sp.) and by a rim blight due to a species of *Phyllosticta*. *Diplodia* sp. caused a die-back of scions of bud-grafted plants.

A mildew isolated from young green fruits of rambutan (*Nephelium lappaceum*) from Johore was identified as *Oidium* sp., closely resembling *O. heveae* [ibid., xviii, p. 272], but inoculations of young rubber leaves gave no results.

Bacterial canker (*Phytomonas* [*Pseudomonas*] *citri*) [ibid., xviii, p. 234] occurred on Italian lime at Serdang, causing fewer and larger cankers than those typically formed on other citrus varieties, and producing circular lesions on the leaves.

A *Fusarium* sp. forming a *Nectria* stage in pure culture was isolated from a serious bark rot of the Mediterranean sweet orange at Serdang, but inoculations gave negative results. The disease appears to be identical with that reported from Java.

A fungus identified as *Calonectria diploa* (B. & C.) Wr. with a conidial stage *Fusarium juranum* was found to parasitize a Diaspid scale insect on pomelo seedlings and *Hevea* rubber leaves.

Sphaerostilbe repens is recorded on lemon trees [cf. ibid., xv, pp. 2, 717; xvii, p. 671] killed by a root disease at Kuala Kangsar, Perak, and the same fungus caused heavy mortality of casava growing in Lower Perak on heavy clay soil subject to waterlogging.

Fomes noxius was isolated from a brown decay at the base of the stem of an avocado pear tree at Serdang, and a fungus resembling *U. zonata* from the tap-root and one lateral root of this tree.

Helminthosporium papayae [ibid., xi, p. 662] and *Mycosphaerella caricae* [ibid., xv, p. 240] were associated with a leaf disease of the Morado variety of papaw at Serdang, recorded for the first time in Malaya.

A fungus of the *Coryneum* type was associated with a disease of nutmeg in the provinces Wellesley and Malacca, the symptoms being typical of the disease attributed in Java to *C. myristicae* [ibid., xiv, p. 152].

A leaf disease of minor importance caused by *Cercospora cruenta* [ibid., xvii, p. 843], occurred on beans [*Phaseolus vulgaris*] at Cameron Highlands.

Phytophthora colocasiae [ibid., xvii, p. 731] is recorded for the first time from Malaya on leaves of *Colocasia* from Langkawi Island.

The mushroom *Marasmius semiustus* [*M. stenophyllus*: ibid, xviii, p. 328], attacked Manila hemp [*Musa textilis*] at Serdang and Johore, causing in damp weather a premature withering of the older leaves, which on poor soil may lead to stunting and death of plants.

Rust (*Maravalia crotalariae*) [ibid., xvi, p. 839] caused appreciable damage to the foliage of *Crotalaria* spp. all over the country with the exception of Cameron Highlands, but the attacks were rarely fatal. Another rust occurring on *Tephrosia* has been identified in 1939 by H. Sydow as *Ravenelia tephrosiicola*.

A fungus identified by the Imperial Mycological Institute as *Pythium splendens* var. *hawaiianum* was found to be responsible for the outbreak of wilt of *Piper betle* in Perak in 1937.

WATERSTON (J. M.). **Report of the Plant Pathologist, 1938.**—*Rep. Dep. Agric. Bermuda, 1938*, pp. 22–34, 1939.

This report [cf. *R.A.M.*, xvii, p. 588] on plant disease work in Bermuda in 1938 contains the following items of interest. Early in January, a very heavy loss of Bliss Triumph potatoes resulted from an attack by *Phytophthora infestans* just before digging, with the result that the potatoes were exposed to infection while being dug, and speedily rotted in storage. Owing to very dry weather in March and April, the Irish Cobbler potato crop suffered severely from attack by *Actinomyces scabies*, and many potatoes could not be shipped.

Fomes subroseus [ibid., xvi, p. 646], the agent of red rot in the Bermuda cedar (*Juniperus bermudiana*), effects entry through old wounds or dead branches; affected trees are commercially worthless and easily blown over. *Pestalozzia unicolor* [cf. ibid., xvii, p. 361] is frequently associated (as a secondary invader) with blighted foliage of *J. bermudiana*. No single primary parasite appears to be responsible for the blight; neglect, leading to overcrowding, competition, and shading effects, seems to produce physiological disturbances and predispose the trees to attacks by secondary agencies.

Miscellaneous records include the following. Lima beans [*Phaseolus lunatus*] were severely damaged by a species of *Phyllosticta* associated with leaf lesions caused by *Bacterium phaseoli*, and were slightly affected by *Uromyces phaseoli* [*U. appendiculatus*]. Carnations, obtained as cuttings in England, were affected by wilt (*Fusarium culmorum*) [ibid., xvii, p. 460]; carnation rust (*Uromyces dianthi*) [ibid., xvi, p. 613] was controlled

by sulphur dusting. Foot rot (*F. bulbigenum*) caused some loss to freesia [ibid., xiii, p. 100] plants in the field. Big Boston and Improved Hansen lettuces were attacked by marginal blight (*Bact. marginale*) [ibid., xiv, p. 17]. Stump rot (*Phytophthora parasitica*) [ibid., xvi, p. 797] was locally severe on Eastern lilies [*Lilium longiflorum* var. *eximium*] during wet weather in January, where soil wash was present. The fungus responsible for black scale in lily bulbs and for a premature die-back of the plants in the field has been provisionally identified as *Colletotrichum gloeosporioides*. A die-back of loquat branches at flowering was provisionally attributed to *Bacillus amylovorus* [*Erwinia amylovora*: ibid., xvi, p. 230]. Papaw powdery mildew [*Oidium caricae*: ibid., x, p. 554] was prevalent during winter, especially on young seedlings, which were severely infected. Young salsify plants developed destructive infection by white blister (*Cystopus cubicus*) during spring.

F[ederazione] I[taliana] T[ecnici] A[gricoli]. VIII Congresso internazionale di Agricoltura tropicale e subtropicale. Tripoli, Marzo, 1939. [Italian Federation of Technicians and Agriculturists. Eighth international Congress of Tropical and Subtropical Agriculture. Tripoli, March, 1939.]—Roma, Tipografia 'Arte della Stampa', 1939. [158 pamphlets and 259 French summaries in portfolio.]

At the Eighth International Congress of Tropical and Subtropical Agriculture, held at Tripoli in March, 1939, K. Rouppert (pamphlet 37, 3 pp.) gave an account of field experiments carried out from 1935 to 1938 near Cracow, Poland, in which he obtained complete control of *Synchytrium endobioticum* on potato by treatment of the soil with lime and ammonium sulphate. According to Raciborski these mixtures liberate gaseous ammonia, which is fungicidal. The author considers that this soil treatment for disease control is applicable in all types of climate, and is particularly valuable in tropical and subtropical areas.

A. G. Cabrera (pamphlet 116, 9 pp.) stated that in the Canary Islands Panama disease (*Fusarium* [*oxysporum*] *cubense*) [*R.A.M.*, xii, p. 773] is only of secondary importance, at most, as a factor in the unsatisfactory condition of the banana plantations, which in many instances appears to be due to adverse soil factors. The use of brackish water containing 200 to 250 mg. of sodium chloride per l. has been largely responsible for the poor state of the bananas, especially in argillaceous, shallow, poorly drained soils with an impermeable subsoil. Some damage has also been caused by heavy applications of chemical fertilizers.

F. L. Hendrickx (pamphlet 120, 10 pp.) gives notes on the causes, symptoms, and control of a number of diseases of *Coffea arabica* found at Kiva, Belgian Congo.

L. Petri (pamphlet 121, 27 pp.) discusses, with a large number of examples, the question of the control of plant diseases in tropical and subtropical countries.

G. Trinchieri (pamphlet 122, 4 pp.) recommends the publication of an international list of fungicides, insecticides, and similar materials certified by the phytopathological service of the country of origin as efficacious and harmless to the plants treated.

C. Sibilia (pamphlet 123, 5 pp.) reports three new physiologic races

of *Puccinia graminis* on Italian wheat growing in Abyssinia in addition to the one previously reported [ibid., xvii, p. 732]. The new races are designated A.O.I. 2 (isolated from Sabaudia wheat growing in the district of Biscioftù), A.O.I. 3 (from Riale wheat from Ambò), and A.O.I. 4 (from Gentil rosso × Noè 46 Passerini wheat from Harrar). None of the four races was able to infect Reliance or Vernal wheat, while all produced heavy infection on the Mindum, Acme, and Einkorn varieties. In respect of their ability to infect these wheat varieties they resemble the Kenya strains. All four strains gave type 4 reaction on Mindum and type 3 or 4 on Acme. Races A.O.I. 2 and A.O.I. 3 are of moderate virulence, as is race A.O.I. 1; race A.O.I. 4 is markedly less virulent, though it gave type 4 infection on Khapli wheat, usually considered to be very resistant.

A. Sibilia (summary 222) describes a new race of *P. triticina*, designated Ll, from Libya. It appears to have no analogy with other Mediterranean races of *P. triticina*, except that it is unable to infect Malakoff wheat.

Biologische Reichsanstalt für Land- und Forstwirtschaft Berlin—Dahlem. Wissenschaftlicher Jahresbericht 1937. [Reich Biological Institute for Agriculture and Forestry at Dahlem, Berlin. Scientific Annual Report 1937.]—*Landw. Jb.*, lxxxvii, 5, pp. 567–720, 1 graph, 1939.

The following are among the numerous items of phytopathological interest in this report in addition to those already noticed from other sources. In greenhouse inoculations on potted apple trees (Charlamowsky, Golden Pearmain, Boskoop, and London Pippin grafted on Doussaint) in poor soil, those receiving nitrogen as the sole nutrient sustained heavier damage from scab (*Fusicladium*) [*Venturia inaequalis*], and those given a complete fertilizer were less severely affected, than the controls. Dr. Seeliger's observations at the Naumburg (Saale) branch showed that, of the progeny of *Malus* [*Pyrus*] *floribunda*, *M.* [*P.*] *halliana*, M. [*P.*] *toringo*, and *M.* [*P.*] *baccata*, all locally immune from scab and mildew [*Podosphaera leucotricha*], *Pyrus baccata* f. *genuina* yielded the maximum number of resistant seedlings.

Inoculation experiments by H. W. Wollenweber and H. Hochapfel with strains of *Coniothyrium tirolense* isolated from imported apples [ibid., xvii, p. 187] showed that the decay of pome fruits due to this fungus generally proceeds much less rapidly than that caused by *Diplodia* spp. Representatives of the latter genus under investigation included *D. pseudodiplodia* Fkl, the agent of bark blight and fruit rot of apple, pear, and plum, and three species derived from a number of exotic plants, such as coconut, citrus, banana, cacao, and *Cassia*, viz., *D. palmicola* (Fr.) Thüm., *D.* (*Sphaeropsis*) *paradisiaca* Mont., and *D. pandani* (Lév.) Tassi. With the exception of the last named, these species induced a rapid black rot of pome fruits.

H. W. Wollenweber isolated *Pezicula plantarium*, a new Discomycete, from a cortical blight of sweet cherries in a north German orchard. In pure culture the development of the pycnidia was followed after some months by that of cupulate, stalked, orange-coloured apothecia, 1 mm. in diameter. Apple and quince fruits inoculated with the fungus turned

black and rotten in five weeks. W. Bucksteeg's experiments with *Sclerotinia fructigena* and *S. cinerea* [*S. laxa*] from sour cherries [ibid., xvii, p. 687, cf. ibid., xviii, p. 401] in the Lower Elbe valley showed that the overwintered spores of these fungi can survive for a minimum period of six months at 18° C. W. Holz's studies on 'apoplexy' of plums and cherries in the same district revealed the implication of *Valsa cincta* and *V. leucostoma* [ibid., xv, p. 447]. Most of the stocks used for grafting in the affected orchards, especially myrobolan [*Prunus divaricata*], were found to possess a disproportionately high osmotic capacity in comparison with the scions. Good control was obtained by the excision of the lesions and painting the wounds with quinosol-vaseline.

In Dr. Seeliger's experiments on the varietal reaction of vines to downy mildew (*Peronospora*) [*Plasmopara viticola*], oospores of the fungus developed in the open only on highly susceptible varieties of the Vinifera group, but on cut leaves in Petri dishes at 25° they were produced in four to eight days on such resistant types as Arizonica, Berlandieri (G. 172), Californica, Riparia, Rupestris du Lot, Champinii ×Rupestris G. 9 (Na. 263), Longii, Rupestris×Cinerea, Solonis, and hybrids between Vinifera and Aestivalis, Monticola, Riparia, and Rupestris. Dr. Gollmick's inoculation tests on vines with *Pumilus medullae* [ibid., xviii, p. 294] and Zweigelt's unidentified organisms M and N [ibid., xvii, p. 499] gave negative results in respect of the living wood, though the dead pith was readily colonized. True melanose (brown spotting) of vine leaves [ibid., viii, p. 223] was found by the same workers to be hereditary. The disease is of importance only when the green portions of the shoots are involved in addition to the mature wood; the European and some of the American varieties examined suffered from the milder form of the disease. Strict economy in the use of copper being essential, 23 preparations almost or entirely free from this element were tested against downy mildew by H. Zillig and Dr. Wilhelm at the Bernkastel-Kues (Moselle) branch, with satisfactory results only in seven cases. The efficacy of 0·25 per cent. Bordeaux mixture was increased by an admixture of lime-sulphur and neutral paste, but not by that of 0·2 per cent. colloidal sulphur. A high degree of toxicity to the zoosporangia of the fungus was manifested by hypoflavin and quinosol, and also (in acid solutions only) by aluminium compounds.

Good control of *Didymella lycopersici* on tomatoes [ibid., xvi, p. 801] was secured by H. Orth by the disinfection of the training wires with 1 per cent. formalin, which reduced the incidence of infection from 47·5 to 12·8 per cent. *S*[*olanum*] *racemiflorum*, *S. racemigerum*, and *S. pruniforme* proved highly resistant to the fungus in two years' greenhouse and field tests.

The Delikatess cucumber was found by H. Schultz to be very resistant in the field to *Cladosporium cucumerinum* [ibid., xi, pp. 688, 690], which showed evidence of physiologic specialization.

In Dr. Heiling's pot experiments complete control of *Plasmodiophora* [*brassicae*] on cabbage was obtained by the application to the soil of mercuric chloride, mustard oil, or formalin at the rates of 0·15 gm., 3 c.c., and 1·5 c.c. per l. soil, respectively. Field experiments gave essentially comparable results, except in the case of formalin, which

proved ineffectual. The infective capacity of the spores was practically destroyed by half an hour's immersion in water heated to 70°. The water absorption and transpiration of infected cabbage and mustard plants were found to show an initial increase followed by a rapid and persistent decline. In H. Pape's experiments in the Schleswig-Holstein marshes the disease was effectively combated by strewing blue sand from the subsoil over the surface of the soil. The Seefeld turnip showed outstanding resistance in varietal reaction trials, Pomeranian Tankard and Heinkenborstel also sustained little damage, but Wilhelmsburg was heavily attacked.

W. Straib's studies on physiologic specialization in *Melampsora lini* on flax [ibid., xvi, p. 612] resulted in the separation of five races, two of which corresponded exactly in their mode of infection on 349 out of 350 varieties but differed appreciably on the remaining one. Most of the resistent or immune varieties belonged to the South American oil-yielding types.

Surprising inconsistencies in the reactions to races 13, 20, 31, and 19 of brown rust of wheat (*Puccinia triticina*) [ibid., xvii, p. 733] were observed by K. Hassebrauk in the standard Carina and Brevit varieties under different environmental conditions. At low temperatures, for instance, these varieties acquire resistance to all the races attacking them at high ones, and it is doubtful whether the separation of certain races hitherto regarded as distinct, e.g., 13 and 20, can be maintained in future.

The aphid *Doralis* [*Aphis*] *rhamni* was experimentally shown by K. Heinze to transmit 'browning' (cucumber virus 1) from diseased to healthy lupins [ibid., xvi, p. 680], of which the alkaloid-free *Lupinus angustifolius* was chiefly used in the tests. The symptoms are completely masked in greenhouse lupins, and infection could only be verified by the inoculation of test plants with the expressed juice by rubbing. The following plants were found to harbour the virus: *Viola tricolor*, *Aquilegia vulgaris*, *Scabiosa maritima* var. *atropurpurea*, *Senecio elegans*, *Eryngium planum*, wallflower, *Zinnia* sp., *Chelidonium* sp., spinach, tomato, *Stellaria media*, *Capsella bursa-pastoris*, and *Galinsoga parviflora*.

Versuchs- und Forschungsanstalt für Wein-, Obst- und Gartenbau Geisenheim a. Rh. Wissenschaftlicher Jahresbericht 1937. Scientific Annual Report for 1937 of the Experimental and Research Institute for Viticulture, Fruit-Growing, and Horticulture at Geisenheim-am-Rhein.]—*Landw. Jb.*, lxxxvii, 3, pp. 345–382, 1939.

This report contains the following among other items of phytopathological interest [*R.A.M.*, xvi, p. 230]. An intensive study was made by C. F. Rudloff and collaborators of the twig infection phase of pear scab (*Venturia pirina*), the cytological development of the pustules being investigated, the mode of dissemination of the conidia followed, and preliminary control experiments initiated. In addition to excision of the diseased material very satisfactory results were given by the application to the trees of a saturated 'network' of Bordeaux mixture: the showers that liberate the scab conidia simultaneously release sufficiently large amounts of copper to preclude infection in most cases.

This principle of the 'ever-ready spray reservoir' also underlies to some extent the practical and effective 'blue' treatment [ibid., xvi, p. 541 *et passim*]. The blossoms were not injured by the copper in the orchard tests, though in the laboratory the germinability of pollen of different varieties was impaired by contact with a $\frac{1}{5000}$N copper sulphate solution. The movements of the conidia were studied by means of a specially constructed apparatus known as a 'conimeter' (C. Zeiss, Jena); these spores were found to be almost exclusively responsible for the establishment of primary infections, the ascospores being of little importance in this connexion during the period under review. Greenhouse inoculation experiments on about 200 trees in tubs and one-year-old potted grafts revealed variations in the 'aggressiveness' of the different physiologic races corresponding to the morphological peculiarities of the hosts. The best method of combating storage scab was found to lie in the rational fungicidal treatment of the fruits during the growing period.

A number of vine selections resistant to *Plasmopara viticola* have been obtained by planting the vegetative progeny of the best Riesling clones in the open and exposing them to spontaneous infection.

In further studies by F. Stellwaag and assistants on the heritability of 'reisigkrankheit' of the vine [ibid., xviii, p. 86] in some 1,800 seedlings no differences in vigour could be detected between the progeny of healthy×diseased parents and those of the reciprocal cross; the incidence of double nodes was as follows: healthy×healthy 1·3, diseased×diseased 1·6, diseased×healthy 1·2, and healthy×diseased 0 per cent. The germinability of pollen from diseased vines tends to be reduced in comparison with that from sound material. An examination of the auxin content of 'reisig'-diseased and healthy vine shoots showed that, although the accessory growth factors are just as well represented in the more vigorous affected shoots as in sound ones, the total content of the former is apt to be inferior owing to their general failure to attain the normal diameter.

K. Hening and co-workers successfully inoculated both wounded and uninjured grapes of the thick-skinned dessert variety Blue Ox-eye, with *Botrytis cinerea* [ibid., xviii, p. 295], the dense mycelium of which covered the substratum in a week. Experiments were also carried out in the inoculation of crates of Riesling grapes with dry spores of the fungus with a view to imparting a characteristic aroma to the must. In some cases vitamin B was added to stimulate the immediate development of the spores, with very satisfactory results. The flavour of the treated product was sufficiently palatable to justify the use of the method in seasons when the natural bouquet of the must needs improvement.

B. cinerea was observed by C. Rudloff to occur in a parasitic form [cf. ibid., xvii, p. 686] on Mefo white chrysanthemum blooms, producing small, rust-coloured, red-bordered spots and larger greyish-brown ones.

RIKER (A. J.). **Physiological relations between host and parasite in crown gall—an example of basic biological research with plant material.**—*Amer. J. Bot.*, xxvi, 3, pp. 159–162, 3 figs., 1939.

This is an abridged version of a paper summarizing recent research

on crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) [*R.A.M.*, xviii, p. 381] read in December, 1938, before the American Association for the Advancement of Science.

SNIESZKO (S. F.) & PALUCH (J.). **The influence of some digestive ferments on the experimental crown-gall.**—*Science*, N.S., lxxxix, 2305, p. 200, 1939.

This work on crown gall (*Pseudomonas* [*Bacterium*] *tumefaciens*) has already been noticed from another source [*R.A.M.*, xviii, p. 296].

MEHTA (K. C.). **The dissemination of cereal rusts in India.**—*Proc. Indian Sci. Congr., 1938*, Part iv, pp. 137–140, 1939.

Opening a discussion on the dissemination of the cereal rusts [*Puccinia* spp.] in India the author sums up the present state of knowledge on the subject [*R.A.M.*, xiii, p. 499]. Observations made on wind curves seem to indicate that the rusts are disseminated from hill stations where they survive the summer temperatures and where, on account of early sowings, they are found a few weeks earlier than in the plains. In order to prevent this spread, wheat and barley should not be sown anywhere in Nepal before October, and in the Nilgiris and Palni hills the first crop of wheat and barley, usually sown between April and June, should be discontinued. In addition all self-sown plants and tillers of wheat and barley should be rigorously destroyed in all hilly districts one to two months before the sowing. In the discussion which followed, these recommendations were supported by Prof. A. H. R. Buller and others.

BOEWE (G. H.). **Range extensions for Naucoria cerealis in Illinois in 1938 and a key to certain species in the genus.**—*Plant Dis. Reptr*, xxiii, 2, pp. 24–27, 1939. [Mimeographed.]

As a result of field work in 1938, the known distribution of *Naucoria cerealis* [*R.A.M.*, xviii, p. 164] in Illinois has been extended to cover five new counties. A key is given of all species of *Naucoria* known or presumed to be associated with living plants.

GODDARD (MARY). **Studies on variation in Gibberella saubinetii (Mont.) Sacc. (Fusarium graminearum Schwabe).**—*Ann. Mo. bot. Gdn*, xxvi, 2, pp. 99–164, 8 pl., 1 fig., 1 diag., 1939.

In studies at the Missouri Botanical Garden on the influence of environmental conditions on variation in *Gibberella saubinetii* [*R.A.M.*, xviii, p. 97], 98 conidial isolates of two strains of the fungus were grown on potato dextrose agar and then transferred to various media to determine the relative stability of the strains. Only one variant remained stable through five generations in one strain and two in the other, while all the other variants eventually reverted to the parental type. These three stable variants and six other conidial isolates were then grown on Brown's, Coons's, Leonian's, Richards's, and potato dextrose agar at 18°, 20°, 25°, and 30° C., and produced both 'ecovariants' (temporary variants due to environment) and permanent variations. Both occurred more readily at the lower temperatures on

Leonian's agar, which was also the best medium for development, the optimum growth temperature being 25°.

Grown on five different media and at four different temperatures cultural sectors of the mycelial type, which had previously formed no conidia, produced these organs in large numbers, while those of the conidial type changed to aerial forms and yielded either very few or no conidia. In a series of transfers a culture was observed to pass from the aerial mycelial phase through the conidial and the appressed to the pionnotal and back again to the aerial mycelial phase, the latter being comparable to the description of the original ascospore isolate of the fungus from maize stubble. On the basis of these observations it is tentatively suggested that these variations represent different phases in the cycle of growth through which the fungus passes, and not separate strains within the species.

When two contrasting strains of the fungus were allowed to germinate on the same drop of agar or the mycelia were mixed, no new or intermediate strains were produced, and although nuclear migration occurred in hyphal anastomoses no instance of caryogamy was observed.

The fact that two identical variant sectors are often formed on the culture plate about the same time is interpreted as indicating that the saltation is somatic rather than germinal, as the soma would tend to saltate more or less simultaneously at diverse points, while germinal changes are usually somewhat haphazard and would, even if there were two in the same culture, most probably not be identical.

Straib (W.). **Der Einfluss des Entwicklungsstadiums und der Temperatur auf das Gelbrostverhalten des Weizens.** [The influence of the stage of development and of temperature on the reaction of Wheat to yellow rust.]—*Phytopath. Z.*, xii, 2, pp. 113–168, 3 figs., 1 graph, 1939.

In studies carried out at Gliesmarode, Brunswick, from 1934 to 1938 on the reaction of wheat to physiologic races 2, 7, and 9 of yellow rust (*Puccinia glumarum*) in relation to the prevailing temperature and stage of development of the plants [*R.A.M.*, xviii, p. 167], three groups were differentiated, viz., (1) acquiring enhanced resistance with advancing age and lateness of the season ('summer resistance'), (2) equally susceptible at any age and all times of year, and (3) uniformly resistant at temperatures above 10° C. Group (1) includes Criewener 104, Stocken, Hörning's Grüne Dame, Garnet, and Svalöf's Kronen (in respect of all three races), and Strube's Dickkopf, Baltikum, Rimpau's Hybrid, Cimbal's Grossherzog, Peragis Summer, and (under certain conditions) Minhardi and Roter Schlanstedt Summer (races 2 and 7); (2) Michigan Amber and Buffum (all three races), Heine's Club and Ridit (race 9), and Rouge prolifique barbu (race 2); (3) Heine's Club, Ridit, Aurora, and Czaribrod Spelt (race 2); the foregoing with the addition of Rouge prolifique barbu (race 7); Strube's Squarehead, Baltikum, Carsten's V, Spalding's Prolific (immune), Cimbal's Grossherzog, Salzmünde Standard, Svalöf's Kronen, Czaribrod Spelt, and Rouge prolifique barbu (race 9).

Parallel series of greenhouse experiments with plants at varying stages of development substantiated the conclusion drawn from earlier

investigations that summer resistance develops principally under the influence of rising summer temperatures. This was further exemplified by the observation that in the later stages of development certain varieties reacted to a rising temperature by considerably greater increases of resistance than the younger plants, especially seedlings. Varieties reacting in this way to the environmental factors concerned are virtually immune from yellow rust during the main growing period (May to July), but may bear a profusion of pustules in the autumn and winter. The intensity of resistance acquired through the operation of high temperatures is naturally greater in hot than in normal or cool summers, while further modifications in a direction adverse to the host may be introduced by unbalanced nitrogenous manuring and simultaneous infection by *Tilletia tritici* [*T. caries*: ibid., xviii, p. 302]. The extreme degrees of summer resistance and susceptibility in many varieties may best be gauged in the field. Helen Hart's theory of functional resistance [ibid., xi, p. 562] is of some interest in connexion with the initiation of yellow rust infection, since differences were established in respect of germination rate between the various physiologic races.

A cold, dry spring (April to May) was found to restrict the dissemination of *P. glumarum* even in the presence of sufficient overwintered foci of infection, whereas warm and relatively humid conditions favour both fructification and fresh outbreaks. On the other hand, persistent heavy rains impede the activities of the rust. Thus a warm, dry June with heavy night dews may provide better conditions for the development and spread of yellow rust than a cool, rainy month, as long as the maximum temperatures for the viability of the mycelium are not exceeded for any considerable period. The bearing of these environmental factors on the practical aspects of comparative field and greenhouse trials is discussed, and the importance in the formation of correct judgements as to varietal reaction of uniformity in the prevailing temperature, light, and humidity conditions emphasized.

MEAD (H. W.). **Shrivelling of Wheat kernels by stem rust and its effect on seed value.**—*Sci. Agric.*, xix, 7, pp. 481–493, 1 fig., 3 graphs, 1939.

Direct examination and analysis of normal wheat seeds and of wheat seeds shrivelled by stem rust [*Puccinia graminis*] demonstrated that in the latter the dry weights of the embryos, fibre, and endosperm were, respectively, 41·6, 57·1, and 37·0 per cent. of those in the normal seed. The shrivelled seed germinated nearly as well as normal seed, but when sown in soil under greenhouse conditions it produced fewer and weaker plants than normal seed, these plants also emerging later, having smaller root systems, and being lighter in weight than the plants from normal seed. In field plot tests using seed inoculated with the common root-rot fungus, *Helminthosporium sativum*, the seedlings from the shrivelled seeds showed poor resistance to common root rot which produced more seedling blight than on plants from healthy seed, the reduction in emergence of normal and shrivelled seed being 11 and 40 per cent., respectively, and the corresponding reductions in yield 7 and 40 per cent. In greenhouse tests weak seedlings also suffered greater permanent damage from severe top injury than did normal ones, but they withstood freezing and prolonged drought as well as those

from normal seed. Treatment of the shrivelled seed with formalin seriously reduced germination and emergence, and appeared to make the seedlings very susceptible to *H. sativum*. Treatment with new improved ceresan and leytosan [*R.A.M.*, xvii, pp. 605, 797] was slightly beneficial. Good stands and yields were obtained in replicated field plot tests with the uninoculated shrivelled seed, many more grains of which were sown than of normal seed because of their shrivelled condition.

FITTSCHEN (H. H.). **Weitere Beiträge zur Züchtung steinbrandresistenter Weizensorten.** [Further contributions to the breeding of bunt-resistant Wheat varieties.]—*Phytopath. Z.*, xii, 2, pp. 169–218, 1939.

In this further extensive contribution to the technique of breeding wheat varieties for resistance to bunt (*Tilletia tritici*) [*T. caries*] in Germany on the lines laid down by Roemer and Bartholly [*R.A.M.*, xiii, p. 293], the writer presents additional evidence for the modifications in aggressiveness induced in different collections of the fungus by multiplication on certain test varieties, e.g., Hohenheimer 77 and Heil's Squarehead. The various 'lines' of a bunt population may also be distinguished in some cases by variations in the size of the spore balls, and in the effects induced on the height and tillering of the host.

The aggressiveness of a large number of new collections tested was in general of a low order initially, but could mostly be enhanced by reproduction on the standard assortment. Few of the winter and summer wheats (100 of each) inoculated with five individual bunt lines showed any appreciable degree of resistance, the best in the former category being the American varieties Oro, Martin, Minturki, and Ridit, and in the latter Greek 4 and 12, Spanish 9, *Triticum timopheevi* (immune from all five), and Hope. The inoculation of an assortment comprising Ridit, Hohenheimer 77, Heil's Squarehead, and Panzer III with spore mixtures of different lines resulted in a general lowering of infectivity, which was even more marked in the effects induced by the progeny of the blends on the same varieties with the addition of Hussar and White Odessa. Among the factors operating in this decline of virulence in the combinations as compared with pure lines of bunt are a diminution in the number of highly aggressive spores, differences in the extent and velocity of germination, and variations in sporidial production and in the abundance of production of mycelium [ibid., xviii, p. 303].

Discussing the problem of the method of choice for inoculation tests in connexion with breeding work, the writer advocates the use, in the first place, of a highly aggressive spore mixture to eliminate the most susceptible plants, followed by a similar procedure for the progeny of the remainder, and by the exposure of the survivors of this second trial to infection by individual virulent lines or races.

GUILLOCHON. **La lutte contre le charbon nu du Blé en Tunisie.** [The campaign against loose smut of Wheat in Tunis.]—*C.R. Acad. Agric. Fr.*, xxv, 11, pp. 448–452, 1939.

A note is given on the treatment of Florence × Aurora and other wheat varieties in Tunis by immersion in hot water (45 minutes at 45° and then 10 at 52° C.) against loose smut (*Ustilago tritici*) [*R.A.M.*, xvi,

p. 802]. This method of disinfection is stated to destroy the spores completely without causing more than 5 to 7 per cent. loss of germinative capacity. The apparatus consists of three parts: a vat with a capacity of 35 cu. m. for the water at 45°, another of 20 cu. m. for the second lot of water (52°), and a drier, fitted with five ventilators, on which the grain remains for two hours. About 200 quintals of seed-grain can be treated daily.

SIMMONDS (P. M.). **Root development in relation to root rots of cereals.**—*Sci. Agric.*, xix, 7, pp. 475–480, 1939.

In this paper the author discusses (with numerous references to the relevant literature) observations made in Saskatchewan on the relations between cereal (mainly wheat) root development and root rots, i.e., take-all (*Ophiobolus graminis*), browning root rot (*Pythium* spp.), apparently following nutritional disturbances, and the common root rot caused by *Helminthosporium sativum* and *Fusarium* spp. The conclusions reached may be summarized as follows. Cereal seeds that have become injured in any way always produce plants predisposed to attack by root-rot fungi. During the seedling stage (from germination until emergence of crown roots), when the plants are supported entirely by the seminal roots, root infections cause much injury, generally accompanied by shoot symptoms. Infection of the crown, crown roots, and tiller buds in post-seedling attack is particularly severe when the deeply penetrating seminal roots are also infected. Root-rot infections are in many respects comparable to mechanical injuries in both seminal and crown roots.

BRIGGS (F. N.) & STANFORD (E. H.). **Linkage of factors for resistance to mildew in Barley.**—*J.Genet.*, xxxvii, 1, pp. 109–117, 1939.

In further studies in California on the inheritance of resistance to mildew (*Erysiphe graminis hordei*) in crosses between the three resistant barley varieties Algerian, S.P.I. 45492, and Kwan and the susceptible Atlas [*R.A.M.*, xvii, p. 384] the three resistant were each found to differ from the susceptible by a single factor for resistance to the disease. The same factor (designated as the Algerian), differing from those previously detected in Hanna, Goldfoil, and Arlington Awnless, is common to both Algerian and S.P.I. 45492, while Kwan possesses yet another factor (Kwan). The genetic constitution of the eight mildew-resistant varieties so far investigated is expressed by means of formulae, based on the six different factors, the largest number recorded in connexion with any single plant disease. The Algerian and Kwan factors were found to be linked with a cross-over value of 9·81 per cent., based on F_3 data and agreeing substantially with computations from F_2 figures. The other four factors were inherited independently. The Algerian factor for resistance to *E. graminis hordei* revealed independent inheritance with the factor pair long-haired v. short-haired rachilla.

GADD (I.). **Några iakttagelser rörande förhållandet mellan graden av Fusariumsmitta å kärnorna och broddens overvintring hos Höstråg på Bergshamra vintern 1937–38.** [Some observations concerning

the relationship between the degree of *Fusarium* infection of the grains and the overwintering of young autumn-sown Rye at Bergshamra during the winter of 1937–38.]—*Medd. Frökontrollanst. Stockh., 1939,* 14, pp. 62–80, 2 figs., 1939. [German summary.]

Following a general survey of the development and present status of *Fusarium* research and control in various countries, with special reference to Sweden, where diseases of this group are stated to be very widespread and destructive, notably that caused by *F. minimum* [*Calonectria graminicola*: *R.A.M.*, iii, p. 727; xix, p. 21] on rye, the writer discusses and tabulates the results of an inspection, during the winter of 1937–8, of 128 samples of untreated rye seed-grain representing 14 varieties. The incidence of overwintering was graded according to a scale ranging from 0 (total loss) to 5 (no damage), and that of fungal infection by similar gradations in the reverse direction, i.e., 0 = complete freedom and 5 = very severe infection. The correlation coefficient for these two values was found to be as high as r = −0·860, affording confirmation of the exactitude of the methods in use at the Seed Control Institute. The data further provide reliable indications for directions regarding seed-grain.

No conclusive evidence emerged of differences in varietal reaction to primary infection, nor did the plants arising from severely diseased seed contract heavier damage than those proceeding from absolutely or relatively sound material, possibly owing to unfavourable local weather conditions for seed-grain infection in the summer of 1938. The most susceptible of the varieties tested was Agro (overwintering 0, incidence of infection 5) and the most resistant Oiva (5 and 1, respectively).

Lincoln (R. E.). **Host-parasite interactions with bacterial wilt of Maize.** *Science*, N.S., lxxxix, 2303, pp. 159–160, 1 graph, 1939.

When mixtures of virulent and avirulent strains of *Bacterium* [*Aplanobacter*] *stewarti* [*R.A.M.*, xvii, p. 238], the agent of wilt of maize, were inoculated (by means of hypodermic injections into the growing point) into resistant and susceptible inbred lines of maize seedlings, subsequent isolations at suitable intervals showed that the proportion of virulent to avirulent strains (as judged by the type of colony produced [loc. cit.]) underwent a change during passage through the host plant. On passage through a susceptible host the change was toward a higher proportion of avirulent types, an initial proportion of 50 virulent to 50 avirulent bacteria changing after a 15-day passage into one of 39 to 61, respectively. The rate of change was slow when the inoculum contained a high proportion of avirulent bacteria. On passage through a resistant host the change was toward a higher proportion of virulent types, the initial 50 to 50 proportion changing into one of 63 to 37. The rate of change was slow (up to 100 per cent. virulent organisms) when the inoculum was largely composed of virulent types and rapid in one containing few. Plotting these rates of change against the initial proportion of avirulent bacteria in the inoculum, the slope or regression of the rates is linear and equal to −1·1 in the susceptible, and to −1·7 in the resistant host. The changes went on progressively from the time of the inoculation to the

death of the plant. Virulent bacteria killed the susceptible host in 10 to 15 days, but only stunted the resistant one, while the avirulent bacteria stunted the susceptible host and caused only the first early lesions in the resistant one. It is suggested that the low degree of virulence of bacteria adapted to the susceptible host and the high degree in the resistant establishes a most advantageous host-parasite relationship, as the bacteria thus possess sufficient virulence to overcome the resistance of the host without killing it.

KOEHLER (B.) & HOLBERT (J. R.). **Combating Corn diseases in Illinois.**—*Circ. Ill. agric. Exp. Sta.* 484, 35 pp., 1 col. pl., 22 figs., 1938. [Received June, 1939.]

Brief, popular notes are given on the chief diseases affecting maize in Illinois and their control.

GOIDÀNICH (G.). **Le più importanti malattie del Sorgo, con speciale riferimento a quelle del Sorgo zuccherino.** [The more important diseases of Sorghum, with special reference to those of saccharine Sorghum.]—*Industr. saccar. ital.*, xxxii, 2, pp. 77–102; 3, pp. 166–168, 2 col. pl., 25 figs., 1939.

This is a valuable summary of the essential available information on the symptomatology, etiology, distribution, and control of the following diseases of sorghum, with special reference to the saccharine varieties: smuts (*Sphacelotheca sorghi*, of which the author recently received material from Bologna, *S. cruenta*, *Tolyposporium ehrenbergi* [*R.A.M.*, xvi, pp. 97, 598], *Sorosporium reilianum* [ibid., xviii, p. 373], present in Italy since 1910, and the less important *Ustilago sorghicola*, *U. bulgarica* [ibid., xii, p. 617], allied to *Sphacelotheca sorghi* and *S. cruenta*, respectively, *T. volkensii* in East Africa, and *Sorosporium simii* Evans, resembling *S. reilianum*); rust (*Puccinia purpurea*) [ibid., xviii, p. 375]; helminthosporiosis (*Helminthosporium turcicum*) [ibid., xviii, p. 438], anthracnose (*Colletotrichum graminicolum* and *C. andropogonis*) [ibid., xv, p. 494], leaf blight (*Phoma insidiosa*) [ibid., ix, p. 506], and bacterioses (*Bacterium andropogoni* [ibid., xv, p. 346], *Bact. holci* [ibid., xiii, p. 571], *Bact. holcicola* [ibid., xvii, p. 223], and the relatively insignificant *Bact. alboprecipitans*, *Bact. rubrilineans*, *Phytomonas rubrisubalbicans* [ibid., x, p. 129], *Aplanobacter stewarti*, and *Bact. vasculorum* [ibid., xiv, p. 354]; root rots (*Pythium arrhenomanes* [ibid., xviii, p. 444], *P. graminicolum* [ibid., xvii, p. 384], and *Macrophomina phaseoli* [ibid., xvi, p. 130]; collar rot (*Sclerotium delphinii*) [ibid., xviii, p. 182], occurring in Sicily; seedling blight (*Fusarium moniliforme*) [*Gibberella fujikuroi*: ibid., xiii, p. 59]; parasites of subsidiary importance (*Sphacelia sorghi* [ibid., x, p. 360], *Fusarium avenaceum*, *Ascochyta sorghina* [ibid., xvii, p. 388], *Cercospora sorghi* [ibid., xvi, p. 493], *C. longipes* [ibid., iv, p. 146], *Acrothecium lunatum* [*Curvularia lunata*: ibid., xv, p. 597], *Sclerospora sorghi*, *Botryodiplodia sorghi*, and *H. halodes* [ibid., xv, p. 465]); viruses (mosaic or *Saccharum* virus 1 [ibid., xiv, p. 258; xv, p. 558], Storey's grass mosaic or *Saccharum* virus 1 A [ibid., ix, pp. 560, 724], and stripe or *Zea* virus 1 [ibid., xiii, p. 225]).

Descriptions are also given of two diseases occurring in Italy, one known as 'red stripe' and believed to be due to a virus, and the other of

uncertain origin, characterized by dark ferruginous spots of varying size scattered over both leaf surfaces (red leaf spot). Red stripe, which is prevalent and severe, induces far-reaching anatomical and cytological degeneration in addition to the external symptoms of chlorosis, red striation, tissue necrosis, and perforation or laceration of the leaves. The most resistant varieties are Gigante, Honey, Vienna (all 100 per cent.), and Folger (80), while Japanese Honey is very susceptible (30).

A note is appended on the obscure etiology of sorghum blight, commonly referred to *Bact.* [*Bacillus*] *sorghi* [ibid., xvi, pp. 19, 588] but actually, according to the author's studies in Italy, associated with a complex of factors, including red stripe, aphids, bacteria, and various other parasitic organisms.

Rhoads (A. S.). **Limitations of the bark-scraping method in the control of gummosis and psorosis of Citrus.**—*Proc. Fla hort. Soc.*, li, pp. 114–127, 1938. [Abs. in *Chem. Abstr.*, xxxiii, 10, p. 3959, 1939.]

Bordeaux paste, lime and sulphur paste, lime-sulphur paste and washes, zinc sulphate-lime paste, sodium hydroxide Bordeaux, and the same with lime-sulphur proved very satisfactory as coatings for scraped gummosis [*Phytophthora citrophthora* and *P. parasitica: R.A.M.*, xviii, p. 450] and psorosis [ibid., xviii, pp. 308, 438] lesions on citrus trees in Florida. Lime-sulphur appeared to be the most effective in expediting scaling and exfoliation of the outer cortical layer, the primary aim of the treatment. The proprietary preparations Black Sambo and protexol were highly injurious to the trees, while humisol, preservitol, Avenarius Arrow carbolineum, and dendrin of the same firm, though not deleterious, were no more effective than lime-sulphur.

Camp (A. F.). **Symptomatology of deficiencies and toxicities of Citrus.**—*Proc. Fla hort. Soc.*, li, pp. 145–150, 1938. [Abs. in *Chem. Abstr.*, xxxiii, 10, p. 3949, 1939.]

The symptoms of zinc [*R.A.M.*, xviii, p. 308], copper, magnesium [ibid., xvii, pp. 169, 672], and manganese deficiencies, and of borax poisoning in citrus in Florida are described. Borax poisoning is brought about mainly by (1) the damping of culls in the grove and the careless inclusion of fruit that has been dipped in borax solution and not thoroughly washed afterwards, and (2) the leaving of borax-treated boxes in the field for protracted periods, during which the borax is washed off the boxes by rain and percolates into the soil surrounding the trees.

Reichert (I.). **Palestine: plant diseases of Citrus.**—*Int. Bull. Pl. Prot.*, xiii, 4, pp. 75 m–81 m, 1939.

A preliminary list is given of the fungal, bacterial, virus, and physiological diseases of citrus investigated at the Rehovoth Agricultural Research Station, Palestine, from 1923 to 1938.

Uppal (B. N.) & Desai (M. K.). **Koleroga disease of Areca Nut.**—*Curr. Sci.*, viii, 3, pp. 122–124, 2 figs., 1939.

The perpetuation of *Phytophthora arecae*, causing the koleroga disease of areca palm [*Areca catechu: R.A.M.*, xviii, p. 233] in North Kanara, Bombay Province, is difficult to explain since oospores of the fungus

have not been found under natural conditions. Results obtained by pairing strains of *P. arecae* [ibid., ix, p. 684] isolated from diseased nuts in different localities in North Kanara showed that the sexual strains of the fungus have become definitely isolated in different areas. Strains from the villages Tyagli and Analgar always produced oospores when paired with any one of the other six strains tested, but failed to do so when paired with each other. It is suggested that this localization of the two sexual strains may offer an explanation of the fact that oospore formation has not yet been discovered in nature.

WALLACE (G. B.). **A non-parasitic disease of Arabica Coffee.**—*E. Afr. agric. J.*, iv, 5, pp. 365–368, 3 figs., 1939.

Coffea arabica trees over five years old growing on native plots at an elevation of about 4,400 ft. on the western slopes of Kilimanjaro, Tanganyika Territory, are killed off each year by a condition producing canker-like symptoms on the main stem where the primary branches arise, and on the primary branches where the secondary ones originate. In these parts the bark is very rough and loose, and flakes off; the affected areas under the bark are flat or rather sunken; and in some places the wood is exposed. On the main stem the upper parts are most affected. Transverse sections through diseased branches showed arcs of very dark tissue in the outer rings. These arcs generally became covered with callus tissue, but occasionally the affected parts had failed to heal, and remained exposed and flat. Parts of the diseased bark contained thin wafers of calcium oxalate.

No insect or fungus was associated with the condition, which is attributed to the fact that the trees, as seedlings, had been planted by being pushed into small holes made with a stick; the stems were buried to a depth of six inches, and the roots were twisted and curled. Inadequate cultivation and frequent treading (the soil being apt to pack) had aggravated the condition.

CASTELLANI (E.). **Prima ricognizione fitopatologica in Africa Orientale Italiana.** [First phytopathological survey in Italian East Africa.]—*Agricoltura colon.*, xxxiii, 3, pp. 143–148, 1939.

During an eight months' tour of Eritrea and Abyssinia the author observed that coffee at Faghenà and Merara was widely infected by *Colletotrichum coffeanum* [*Glomerella cingulata: R.A.M.*, xvi, p. 796], the attack being generally confined to the leaves.

MILLER (P. R.). **A survey of Cotton boll rot diseases and the fungi associated with them.**—*Plant Dis. Reptr*, xxiii, 2, pp. 29–32, 1 map, 1939. [Mimeographed.]

In a survey made during 1938 in Virginia, North Carolina, South Carolina, Georgia, and Mississippi to obtain data regarding the prevalence and relative distribution of fungi associated with cotton boll rot, the results obtained [which are tabulated] showed that *Glomerella gossypii* [*R.A.M.*, xviii, p. 25] occurred in 133 out of 141 samples examined. Other fungi found included *Fusarium moniliforme* [*Gibberella

fujikuroi] (in 107 samples), *F.* sp. (67), *Alternaria* sp. (112), and *Diplodia gossypina* (19). Long periods of dry weather were unfavourable to boll rot, but the high percentage of fields (94 per cent.) showing the presence of anthracnose may explain the wide distribution of *G. gossypii* as a cause of damping-off of cotton seedlings. The anthracnose symptoms produced differed from those described by Barre and Edgerton in that the lesions were smaller, and not sunken and brownish with a red border; moist, pinkish spore masses were seldom observed.

Costa (A. S.) & Forster (R.). **Nota preliminar sôbre uma nova molestia de virus do Algodoeiro—mosaic das nervuras.** [Preliminary note on a new virus disease of Cotton—vein mosaic.]—*Rev. Agric., S. Paulo*, xiii, 3–4, pp. 187–191, 8 figs., 1938. [English summary. Received May, 1939.]

Symptoms of vein mosaic, an apparently new virus disease affecting numerous varieties of cotton (*Gossypium hirsutum*, *G. barbadense*, *G. purpurascens*, *G. punctatum*, *G. klotzschianum*, and interspecific hybrids), including some of commercial importance, in São Paulo, Brazil, consist of stunting, shortening of the internodes (bunchy top), a dark green coloration of the leaves, generalized or broken mottling of the veins, rugosity of the lamina, and curling of the margins. Positive results were obtained in inoculation experiments on *G. trilobum*. The disorder under observation differs in various respects from ordinary mosaic [*R.A.M.*, xviii, p. 248], the former, for instance, involving only the veins or their immediate vicinity instead of the intercostal spaces, producing a rugose condition of the dorsal leaf surface absent in the latter, attacking Sakel and other varieties of *G. barbadense* semi-immune from mosaic, and being readily transmissible by grafting, an operation of great difficulty with mosaic material.

King (C. J.) & Parker (R. B.). **Angular leaf spot of Cotton in irrigated valleys of Arizona and New Mexico.**—*Plant Dis. Reptr*, xxiii, 2, p. 32, 1939. [Mimeographed.]

Investigations into the reason for the recurrence of cotton angular leaf spot (*Bacterium malvacearum*) [*R.A.M.*, xviii, p. 390] to a damaging extent in parts of Arizona and New Mexico, even when the rainfall was light and disease-free seed had been planted, showed that rapid spread resulted from the flow of irrigation water applied before volunteer 'carriers' had been removed.

Roubaud (E.) & Descazeaux (J.). **Action de certains champignons prédateurs sur les larves des Strongylidés du Cheval.** [The action of some predacious fungi on the larvae of equine Strongylidae.]—*Bull. Soc. Path. exot.*, xxxii, 3, pp. 290–295, 1 pl., 1939.

Details are given of experiments at the Institut Pasteur, Paris, in the capture and ingestion of the equine parasitic nematodes, *Strongylus* and *Trichonema*, by predacious fungi, of which the most powerful were *Dactylella bembicodes* and *Arthrobotrys oligospora*, while *D. ellipsospora* acted in a similar but weaker manner [*R.A.M.*, xviii, p. 310].

SIEMASZKO (W.) & JAWORSKI (J.). **La coloration du substratum dans les cultures du Beauveria globulifera (Speg.) Picard et les bactéries.** [Bacteria in relation to the discoloration of the substratum in cultures of *Beauveria globulifera* (Speg.) Picard.]—*Bull. Soc. mycol. Fr.*, liv, 3–4, pp. 245–250, 1938 (issued March, 1939).

Various authors have regarded the capacity of species of *Beauveria* to colour the culture medium as a valid specific criterion. In investigations described in this paper a strain of *B. globulifera* [*R.A.M.*, xvii, p. 816] isolated from *Pentatoma rufipes* was found to produce an intense red coloration on potato and an orange coloration in a mineral salts-glucose-agar medium. This coloration was shown to be due to the presence of contaminating bacteria; out of 20 new monosporidial cultures of the fungus only three showed a faint colouring and these cultures were also found to be contaminated with bacteria. Evidence from experiments with monobacterial cultures confirmed the view that the cause of the coloration is not in the fungus itself but in the generally antagonistic bacteria which accompany it.

MARCHIONATTO (J. B.). **'Septobasidium saccardinum' (Rangel) n. comb.** —*Rev. Fac. Agron., La Plata*, Ser. 3, xxii, pp. 59–63, 1938. [Spanish. Received June, 1939.]

A comparison of herbarium specimens of *Septobasidium curtisii*, supplied by J. N. Couch from North Carolina, and a fungus previously referred by the author to *Peziotrichum saccardinum* Rangel [*R.A.M.*, xiv, p. 98] showed that the latter, occurring in the Argentine on *Aspidiotus perniciosus*, is a species of *Septobasidium* but distinct from *S. curtisii*. *P. saccardinum*, which differs from *S. curtisii* in the smaller dimensions (14 to 16 by 3 to 3·5 μ) and smooth texture of its spores (those of *S. curtisii* being traversed by numerous grooves), is renamed *S. saccardinum* (Rangel) n. comb.

BALDACCI (E.). **Ricerche sul potere patogeno dei miceti. I. Esperienze con la Beauveria bassiana (Bals. Criv.) Vuill. sul Bombyx mori L.** [Researches on the pathogenic power of fungi. I. Experiments with *Beauveria bassiana* (Bals. Criv.) Vuill. on *Bombyx mori* L.]—*Atti Ist. bot. Univ. Pavia*, Ser. IV, xi, pp. 154–189, 4 graphs, 1939. [Latin and English summaries.]

Inoculation experiments in which nearly 60,000 silkworms (*Bombyx mori*) were sprayed with an aqueous suspension of the spores of two strains of *Beauveria bassiana* [*R.A.M.*, xviii, p. 379] showed that pathogenicity depended on germinability and on enzymic activity on chitin. Loss of enzymic power was found to precede that of germinability, and spores about ten months old were no longer pathogenic, though still germinable, and cultures from these spores were able to cause infection. Strains kept in culture for long periods were only weakly pathogenic, but regained their original pathogenicity after one passage through the silkworm.

These results do not suggest that any change should be made in the usual precautions taken against muscardine disease due to *B. bassiana*. On the other hand, they provide some explanation of the failure to

control injurious insects by means of fungal infection. Only a small proportion of spores reaches the insects, the remainder dying or losing their germinability and vegetating on inert substrata. In addition, environmental and climatic factors may not favour infection.

[A condensed version of this paper appears in *Boll. Soc. ital. Biol. sper.*, xiv, 1, pp. 52–53, 1939.]

GRIGORAKI (L.) & DAVID (R.). **Caractères biochimiques de Trichophyton asteroides (Sabouraud 1909).** [Biochemical characters of *Trichophyton asteroides* (Sabouraud 1909).]—*C.R. Soc. Biol., Paris*, cxxx, 9, pp. 889–891, 1939.

Continuing their investigations on the biochemical features of the dermatophytes [*R.A.M.*, xviii, p. 393], the writers found that *Trichophyton asteroides* [*T. mentagrophytes*: ibid., xviii, p. 177] from Sabouraud's agar requires a period of some 56 days at 20° C. to dissolve the casein in sterilized skimmed milk; the liquefaction of gelatine at the same temperature commences feebly on the third day. The following colorations developed in cultures at 35° after 30 days in the presence of mannose, glucose, galactose, saccharose, maltose, lactose, inulin, dextrin, and glycerine (15 c.c. per tube and a dozen drops of litmus): reddish-orange 78D, reddish-orange 86, reddish-orange 61, red 11, red 16, red 11, red 36, red 28D, and red 16 (Klincksieck & Valette), respectively. A barely perceptible currant-red tinge denoted the production of indol after about a month.

MINAMI (S.) & HARA (Y.). **Ein Fall von Sycosis trichophytica.** [A case of sycosis trichophytica.]—*Hitu-to-Hitunyo, Hukuoka* vii, pp. 54–59, 1939. [Japanese. Abs. in *Zbl. Haut- u. GeschlKr.*, lxii, 5, pp. 279–280, 1939.]

Sabouraudites asteroides [*Trichophyton mentagrophytes*: see preceding abstract] was found to be the responsible agent in a case of sycosis trichophytica in a 29-year-old man treated at the Fukuoka (Japan) University Dermatological Clinic.

CATANEI (A.). **Étude des teignes du cuir chevelu dans les colonies françaises.** [A study of scalp ringworms in the French colonies.]—*Ann. Inst. Pasteur Algér.*, xvii, 1, pp. 47–57, 1 pl., 1939.

In this first inquiry into the etiology of scalp ringworms in the French colonies, *Trichophyton soudanense* [*R.A.M.*, xviii, p. 177] was found to be responsible for most (31) of the cases of trichophytosis in French West and Equatorial Africa, *T. violaceum* being isolated from nine, and *T. gourvili* [ibid., xiii, p. 577] from five. *T. fumatum* [ibid., xviii, p. 177] was found in one case in Madagascar. Microsporosis in Africa was associated with *Microsporon obesum* [ibid., xvii, p. 175] (21), *M. audouini* (14), *M. audouini* and *T. soudanense* (2), and *M. tardum* [ibid., xvii, p. 599] (1). In the French Indies (Pondicherry) *T. violaceum* was established as the causal organism in nine cases, *T. sulphureum* [ibid., xviii, p. 177] in two, and *T. sulphureum* and *T. violaceum* in one. *T. rubrum* [ibid., xvii, p. 819; xviii, pp. 27, 110, 178] was isolated from two cases and *M. ferrugineum* [ibid., xviii, p. 110] from three in Indo-

China. In inoculation experiments *T. sulphureum* was pathogenic to the guinea-pig and monkey (*Macacus inuus*) and *T. violaceum* (Cameroon strain) to the former.

Mu (J. W.) & Kurotchkin (T. J.). **Statistical and mycological studies of dermatomycoses observed in Peiping.**—*Chin. med. J.*, lv, 3, pp. 201–219, 1939.

Cultural studies were carried out in 29 out of the 92 cases of favus of the scalp examined at the Peiping [Peking] Union Medical College Hospital during the period from 1925 to 1938, in 664 out of 1,104 of tinea [or ringworm] of the scalp, in 47 out of 760 of tinea of the body, in 71 out of 526 of tinea of the hands and feet, and in 16 out of 49 of tinea of the nails. The common clinical features of the five types of mycotic infection are described. Favus of the scalp was most prevalent among male children and young adults of the poorer classes, a similar distribution being characteristic of tinea of the scalp. Males were also more commonly affected by tinea of the body than females. Tinea of the hands, feet, and nails occurred indiscriminately in persons of both sexes and all social strata. Both favus and tinea of the scalp predominated during the spring, while the other disorders were mostly encountered in the summer.

Achorion schoenleini was found to be responsible for all 29 cases of favus of the scalp, *T. violaceum*, *T. ectoendothrix* [cf. *R.A.M.*, x, p. 243], *M. ferrugineum* [see preceding abstract], *T. glabrum*, and *T. cerebriforme* [ibid., xvii, p. 599] for tinea of the scalp (382, 99, 92, 85, and 6, respectively), while *Epidermophyton* [*T.*] *rubrum* [loc. cit.] was mainly concerned in tinea of the body (36), hands and feet (59), and nails (15). *M. ferrugineum* developed in two forms, one characterized by pale yellow, superficially convoluted colonies, with a short, white 'duvet' and the other by an orange-tinged, glabrous, more extensively convoluted growth. *Endodermophyton tropicale* [*T. concentricum*: ibid., xvii, p. 818] was present in three cases of tinea of the body and *Epidermophyton inguinale* [*E. floccosum*] in twelve of tinea of the hands and feet and one of tinea of the nails. There were a number of cases of mixed infection, *T. violaceum* being associated with *T. endoectothrix* in four and with *M. ferrugineum* in 21.

Kurotchkin (T. J.). **The value of Gram stain for differentiation of pathogenic fungi.**—*Chin. med. J.*, *Suppl.* 2, pp. 337–341, 1938. [Abs. in *Bull. Inst. Pasteur*, xxxvii, 6, p. 362, 1939.]

Among the 120 species of fungi pathogenic to man examined by the writer for their reaction to Gram's stain, some were entirely positive, e.g., *Trichosporon* spp. and *Acrotheca* [*Hormodendrum*] *pedrosoi* [*R.A.M.*, xviii, p. 28], others completely negative (many *Trichophyton*, *Achorion*, *Microsporon*, and *Endodermophyton* spp.), while certain organisms, including six species of *Epidermophyton*, *M. fulvum* [ibid., xvii, p. 174], *A. gypseum* [ibid., xvii, pp. 36, 395, 529], and *Aspergillus fumigatus* were negative as regards the mycelium and positive in respect of the spores, and a few, such as *Sporotrichum*, were negative except for their granular contents.

KAMBAYASHI (T.). **Über eine aus dem menschlichen Nagel kultivierte Endodermophyton-Art.** [On a species of *Endodermophyton* cultured from the human nail.]—*Bot. Mag., Tokyo,* liii, 628, pp. 163–168, 1 fig., 1939.

From the finger-nails of a 26-year-old bath attendant suffering from acute onychomycosis, the writer in 1937 obtained in pure culture on various standard media a fungus characterized by a branched, septate mycelium, 4 to 4·5 μ in diameter, and concatenate, intercalary, and terminal chlamydospores, 9 to 20 μ in diameter. On 4 per cent. glucose agar the organism, which is considered to be closely related to *Endodermophyton tropicale* (*E. concentricum*) [*Trichophyton concentricum*: see preceding page], forms cerebriform to furcate, partially concentric colonies of a dirty whitish, faintly amber-tinted colour.

MORIKAWA (T.). **Über Dermatitis verrucosa cephalosporica.** [On dermatitis verrucosa cephalosporica.]—*Mycopathologia,* ii, 1, pp. 60–67, 3 pl., 1939.

A brief description is given of the morphological and cultural characteristics of a fungus isolated from a case of human verrucose dermatitis in Tokyo, the abundant presence of which in the affected tissues leaves little doubt of its being the cause of the disease; the organism was further shown experimentally to be pathogenic to the rabbit, rat, and mouse, but not to the guinea-pig. The author considers it to belong to the genus *Cephalosporium* and names it *C. keratoplasticum* [without a Latin diagnosis]. The conidiophores develop almost perpendicularly to the hyphae; they are simple, septate, mostly 10 to 50 μ long, and bear heads of ten or more conidia at the tip. The conidia are smooth, hyaline, ovoid or elliptical, continuous or occasionally bicellular, 7·5 to 13 by 3 to 4 μ in diameter. The intercalary or terminal chlamydospores are hyaline or frequently granulated and measure 3 to 8 μ in diameter.

GOIDÀNICH (G.), CIFERRI (R.), & REDAELLI (P.). **Identificazione di alcuni lieviti isolati da pasta di legno.** [The identification of some yeasts isolated from wood pulp.]—*Mycopathologia,* ii, 1, pp. 48–51, 1939. [English summary.]

Notes are given on a number of yeasts isolated from stored wood pulp destined for paper-making in Italy [cf. *R.A.M.*, xviii, p. 362], two of which are known to be associated with human diseases, viz., *Mycotorula zeylanoides* [ibid., xvii, p. 39] and *Torulopsis minor* (probably merely saprophytic), while a third is regarded as being probably identical with *Parendomyces albus* Queyrat & Laroche (recorded once, from a vaginal infection), but in view of the incomplete nature of the existing description of this fungus (*Bull. Soc. Méd. Paris,* iii, 28, p. 115, 1909) is named *M. mucinosa* Goid., Cif., & Red., n.sp. ad interim. The fungus has ovate, elliptical, or elongated blastospores, and does not ferment alcohol; it actively assimilates glucose, levulose, maltose, ammonium sulphate, and urea. Other species are identified as *Torulopsis albida, Sporobolomyces shibatanus,* and *S. salmonicolor* var. *typicus.*

DIDDENS (H[ARMANNA] A.) & LODDER (J[ACOMINA]). **An appeal for unification of the generic taxonomy in the Mycotoruloideae.**—*Mycopathologia*, ii, 1, pp. 1–6, 1939.

The authors suggest that the Mycotoruloideae should be divided on morphological grounds into the genera *Candida* [*R.A.M.*, xviii, p. 253] and *Trichosporon*. The former is characterized by the presence of a pseudomycelium with or without a true, septate mycelium, blastospores generally arranged characteristically for each species, and the occasional presence of chlamydospores. Of the other possible names for this genus *Syringospora* was used by Quinquaud for a fungus with endospores and is therefore inadmissible, while *Mycotorula* is characterized by blastospores produced either in verticils inserted at the apex of the pseudomycelial cells, or along the pseudomycelium [ibid., xvii, p. 817], and does not correspond with the wider limits proposed for *Candida*. *Trichosporon* is characterized by the presence of a pseudomycelium and a true mycelium with both blastospores and arthrospores; the true mycelium generally prevails and sugars are never fermented. The essential characters, viz., the presence of both blastospores and arthrospores, were unmistakably indicated in Behrend's description of *T. ovoides* and for reasons of priority this name is accepted instead of the more recent synonyms *Proteomyces*, *Oosporidium* [ibid., x, p. 573], and *Geotrichoides* [ibid., xi, p. 477]. The authors regard *Trichosporon* as a transitional genus between *Candida* and *Geotrichum*. The following revised diagnosis is given of the subfamily Mycotoruloideae: pseudomycelium present, and in several species, a true mycelium; blastospores always present, arising from the hyphae in arrangements often typical for each species; chlamydospores or arthrospores sometimes present.

The authors also propose to divide the genus *Candida* into four groups (1) comprising *C. albicans* and many other species, (2) represented chiefly by *C. krusei*, (3) by *C. pelliculosa*, and (4) by *Mycotorula intermedia* and *Brettanomyces* spp.

DIDDENS (H[ARMANNA] A.) & LODDER (J[ACOMINA]). **On some sporogenous yeasts and their imperfect stages.**—*Mycopathologia*, ii, 1, pp. 28–36, 3 figs., 1939.

In a comparative systematic study [which is described] of about 300 supposedly anascosporogenous yeasts nine strains were found to form ascospores with closely related asporogenous strains. The further investigation of these strains demonstrated, *inter alia*, that *Mycocandida pinoysimilis* var. *citelliana* Red. & Cif. is identical with *Saccharomyces fragilis*, and that *Monilia pseudotropicalis* (= *Candida pseudotropicalis*) [*R.A.M.*, xiii, p. 767] is the imperfect stage of *S. fragilis*. *M. macedoniensis* [ibid., xiv, p. 308] (= *Blastodendrion macedoniense*) and its variety *C. macedoniensis* var. *macedoniensoides* should in future be designated *S. macedoniensis* Diddens & Lodder.

REDAELLI (P.), CIFERRI (R.), & CAVÀLLERO (C.). **Un' ipotesi sull' eterosmosi dei lieviti in rapporto alla dissociazione.** [An hypothesis

concerning heterosmosis in yeasts in relation to dissociation.]—*Mycopathologia*, ii, 1, pp. 12–27, 1939. [English summary.]

From a review of the information at present available on dissociation in the asporogenous yeasts and variability in fungi the authors conclude that dissociation is a case of transitional, reversible, multiple variation in a constant direction: it is not mutation. The population of a cultural clone is composed of individuals with different capabilities (including the ability to produce R and S colonies), and the process that induces dissociation also reduces or even eliminates the activity of one group to the advantage of another. A monogenetic colony may be considered as an 'ecospecies' (in the sense intended by Turesson) including many 'ecotypes'. Thus dissociation in the asporogenous yeasts may be regarded as a cyclogenetic phenomenon.

Experiments with *Mycotorula* [*Candida*] *albicans* [*R.A.M.*, xvii, p. 527], using hypo-, iso-, and hypertonic solutions of saccharose to induce dissociation [ibid., xviii, p. 394] demonstrated marked dissociation of the RS- and R-forms from the S-form, but not of the SR- or S-forms from the R-form. Hence the osmotic power of the yeast cells may be considered as one of the chief factors in dissociation.

From the authors' point of view, the normal S-clone composed only of S-cells is incapable of dissociation; a clone consisting of S-cells and a few R-cells can dissociate into SR- and R-types; a clone of R-type consisting of R- and a few S-cells can dissociate into RS- and S-types; and a clone composed only of R-cells cannot be dissociated.

VACCARI (E.), BALDACCI (E.), & CIFERRI (R.). **Osservazioni comparative sulle specie del genere Malbranchea.** [Comparative observations on the species of the genus *Malbranchea*.]—*Mycopathologia*, ii, 1, pp. 43–47, 1 pl., 1939. [English summary.]

A comparative study of *Malbranchea pulchella* (1882) [*R.A.M.*, xiii, p. 578], two strains of *M. bolognesii-chiurcoi*, one isolated in 1925 by Bolognesi and Chiurco [ibid., vi, pp. 418, 483] and another by Rivelloni in 1938 [ibid., xvii, p. 242], and *M. kambayashii* [ibid., xiii, p. 578], showed all four to be identical. In spite of superficial analogies with the thallospores (arthrospores) of *Actinomyces* and *Geotrichum*, sporulation in *Malbranchea* ends in the formation of true conidia, through the development of a proconidium which is allied to the same organ in *Sporendonema*.

NIÑO (F. L.). **Contribución al estudio de las tricopatias piedricas de Venezuela.** [A contribution to the study of the trichopathic 'piedras' of Venezuela.]—*Mycopathologia*, ii, 1, pp. 7–11, 5 pl., 1939. [English summary.]

An account is given of two affections of the hair found in Venezuela, Colombia, Brazil, and the Argentine, both of the 'piedra' type, one forming black nodules and caused by *Piedraia hortai* [*R.A.M.*, xiii, p. 512; xvii, p. 457], and the other, or 'Colombian piedra', with light nodules, caused by *Trichosporum giganteum* [or *P. colombiana* Dodge: ibid., xii, p. 444] and *T. humahuaquensis*. Of the two last-named fungi, the former does not cause hair lesions, while the latter does, but both may possibly be referable to the same taxonomic entity.

Negroni (P.) & de Villafañe Lastra (T.). **Micosis generalizada y mortal por Trichosporon proteolyticum n.sp.** [A generalized and fatal mycosis caused by *Trichosporon proteolyticum* n.sp.]—*Mycopathologia*, ii, 1, pp. 52–59, 2 pl., 1939. [English and French summaries.]

From a fatal case of generalized mycosis in the Argentine beginning with a lesion in the lungs simulating tuberculosis, a fungus was isolated which in pure culture on plain, dextrose, or glycerine agar, or carrot, formed woolly or downy, whitish or pure white, zonate colonies, with a smooth, yellowish, or brownish reverse. On wort or honey agar the colonies were round, glabrous, flat, slightly brilliant, zonate, with faintly marked radiating furrows, and a smooth and colourless reverse. Arthrospores were present, and the hyaline, branched, septate mycelium measured 1·5 to 3 μ in diameter. In culture, the fungus formed nodular organs, appressoria, funicula, and a racquet mycelium measuring 9 μ in diameter in the thickest parts. The chlamydo-arthrospores measured 3 to 10 μ, or more, by 2·5 to 3 μ. The optimum growth temperature was 37° C. Growth was better on synthetic media containing ammonium sulphate or potassium nitrate as a source of nitrogen than on those containing asparagin. A strong proteolytic action was exerted on wort gelatine, coagulated serum, and milk. The fungus was weakly pathogenic to laboratory animals. It is named *Trichosporon proteoliticum* n.sp. [with a Latin diagnosis].

Kessel (J. F.). **The coccidioidin skin test.**—*Amer. J. trop. Med.*, xix, 2, pp. 199–204, 1939.

Patients suffering from coccidioidal granuloma, prior to the final fatal stages of the disease, gave positive reactions to injection with a 1 in 10 dilution of a 2 per cent. dextrose veal broth culture of *Coccidioides immitis* [*R.A.M.*, xviii, p. 394] in 22 out of 26 cases, the four unsuccessful attempts being made in the terminal phase. Most of the tuberculous patients similarly treated (191 out of 228) reacted negatively to *C. immitis*; on the other hand, 29 guinea-pigs inoculated with *C. immitis* responded positively to the fungus and negatively to the tubercle bacillus. These data are considered to indicate that the coccidioidin skin test is highly specific in its mode of action, paralleling in many respects the tuberculin test and meriting a similar degree of reliance as an aid to diagnosis.

Barker (S. G.). **The rot-proofing of textiles.**—*Proc. Food Group, Soc. chem. Ind.*, i, pp. 102–108, 1 fig., 1938.

In this paper the author discusses in detail the differences in the organic chemical nature of various fibres used for the manufacture of textiles with reference to the selection of suitable antiseptics for the prevention of attack by micro-organisms and of rotting in general. It is essential that any treatment applied shall leave the intrinsic characteristics of the fibre unaffected. Shirlan paste and powder have given excellent results in the preservation of the finer textiles. With the coarser textiles, a high lignin content confers strong resistance to attack by micro-organisms, and with these materials the cost of treatment is almost as important as its effectiveness. For economic reasons methods for the

rot-proofing of textiles must be included in current practice rather than applied as a separate treatment. Treatment must not induce increased brittleness or loss of strength.

Brief references are made to the Thaysen acetylation process whereby the surface of cotton is rendered unsuitable as a nutrient for micro-organisms, the use of an iron-chrome proofer in America, the chromium-cutch method, which gives satisfactory results provided the metallic chromium content is maintained between 2·0 and 2·5 per cent. of the weight of the fibres proofed, and the use of creosote, which has the merit of increasing the ability of fibres for saturation with bitumen used for pipe laggings and cable coverings. In selecting an antiseptic each fibre and fabric must be considered individually in relation to the effect that treatment is likely to have.

Akai (S.). **Studies on the pathological anatomy of the hypertrophied buds of Camellia japonica caused by Exobasidium camelliae.**—*Bot. Mag., Tokyo*, liii, 627, pp. 118–125, 6 figs., 1939. [Japanese, with English summary.]

In this paper the author describes in detail the histological changes produced in hypertrophied buds of *Camellia japonica* by *Exobasidium camelliae* [cf. *R.A.M.*, xiv, p. 532].

Deacon (G. E.). **Notes on a parasitic fungus attacking Rose rust.**—*Rose Annu., 1939*, p. 136, 1 pl., 1939.

Tuberculina persicina [*R.A.M.*, v, p. 314] was found on Brog's canina rose leaves at Norwich parasitizing and immobilizing the spores of *Phragmidium mucronatum* [ibid., xviii, p. 184]. The small, white, globular spores of *T. persicina*, arising from somewhat thick sporophores of irregular outline, form a conspicuous white coating over the rust.

Mähl (A.). **Motorspritze zur Mehltaubekämpfung unter Glas.** [A motor sprayer for mildew control under glass.]—*Blumen- u. PflBau ver. Gartenwelt*, xliii, 12, p. 136, 1 fig., 1939.

Excellent control of rose mildew [*Sphaerotheca pannosa*] under glass is stated to have been obtained in the writer's nursery at Frankfurt-am-Main by the application of the sulphur preparations, erysit, vomasol S [*R.A.M.*, xvii, p. 682], or imprägnit, with the portable motor sprayer Piccolo (Holder-Metzingen).

Gigante (R.). **La variegatura del Tulipano** [Tulip breaking.]—*Boll. Staz. Pat. veg. Roma*, N.S., xviii, 4, pp. 429–454, 3 pl., 12 figs., 1938 (issued April, 1939).

In the spring of 1937 the author received from Rome a number of tulip plants affected with full break [*R.A.M.*, xviii, p. 257]. The symptoms [which are fully described] consisted in leaf chlorosis, white spots on red, and yellow spots on violet flowers, irregular leaf development, dwarfing, and flower abortion. The chlorotic areas on the leaves averaged 345 μ thick, as against an average of 398 μ for the normal green areas; in the affected areas in the leaves, also, the cells were less developed than in the normal areas, the intercellular spaces were reduced,

and the chloroplasts were either absent or yellowish and irregular. In the affected red flowers the white parts averaged 235 μ thick, and the cuticle 3·6 μ thick, compared with 270 μ and 4·8 μ, respectively, for the normal parts, while the corresponding figures for violet flowers were 226 μ, 3·5 μ (yellow areas), 268 μ, and 4·6 μ. The mesophyll cells of the affected leaves and flowers frequently contained spherical, ellipsoid, or irregular X-bodies measuring 9 to 24 by 6 to 17 μ, often with two vacuoles, and generally in close proximity to the nucleus. In the petals of affected flowers the X-bodies were more numerous in the light than the dark areas. Even in unstained material the epidermal and mesophyll cells of the violet and red areas of the affected flowers showed the presence of deep blue nuclei [loc. cit.].

Transmission was effected by grafting pieces of bulbs from affected plants on to healthy bulbs, by inoculating healthy bulbs with juice from diseased bulbs, and by introducing juice from diseased leaves into the leaves of healthy plants by means of a capillary tube. The symptoms produced consisted in leaf variegation and deformation, dwarfing, and floral abortion; flowers were either not produced at all, or they degenerated with great rapidity. The appearance of the plants resembled that described by Ainsworth for Zimmerman's Triumph tulips infected with cucumber virus 1 [cf. ibid., xviii, p. 182].

MILBRATH (J. A.). **Two unusual fungi on ornamental shrubs in the Pacific Northwest.**—*Plant Dis. Reptr*, xxiii, 3, p. 48, 1939. [Mimeographed.]

A fungus isolated from the roots of a plant of *Daphne odora* at Salem, Oregon, was identified in culture by Prof. H. H. Whetzel as *Sclerotium delphinii* [see above, p. 517], stated to occur very rarely on shrubs and trees.

Boydia insculpta [*R.A.M.*, i, p. 92], identified by S. M. Zeller, is reported for the first time in America forming large cankers on branches of a holly from the Puget Sound district of Washington. The disease is stated to cause considerable damage to holly hedges and trees. Perithecia were found fruiting on the cankers; the bicellular ascospores, about 100 μ in length, were markedly constricted at the septum.

GIEGER (M.) & BARRENTINE (B. F.). **Isolation of the active principle in Claviceps paspali—a progress report.**—*J. Amer. chem. Soc.*, lxi, 4, pp. 966–967, 1939.

Claviceps paspali [*R.A.M.*, xviii, p. 460] was at one time believed to contain the same alkaloids as wheat, or rye, ergot [*C. purpurea*: ibid., xviii, p. 314], but the data resulting from the writers' pharmacological investigations on the fungus at the Mississippi Agricultural Experiment Station entirely disprove this assumption. The therapeutic value of the amorphous compound extracted from ground sclerotia was nil, and the administration to a guinea-pig of 50 mg. of the preparation dissolved in Wesson oil produced the intense trembling characteristic of animals fed on the diseased *Paspalum* grass.

LEFEBVRE (C. L.). **Ergot of Paspalum.**—*Phytopathology*, xxix, 4, pp. 365–367, 1939.

Paspalum urvillei was found naturally infected by *Claviceps paspali*

[see preceding abstract] in Georgia in 1936, 1937, and 1938, and *P. notatum* in the last-named year, when a nursery of 23 species and strains was established at the Arlington Experiment Farm, Virginia, for the purpose of artificial inoculations, which were highly successful on *P. urvillei* (90 per cent.), *P. longipilum*, and *P. laeve*, while positive results were also obtained on *P. dilatatum*, *P. ciliatifolium*, and *P. plicatulum*, the two last named, however, being very resistant. In the greenhouse, infection was readily secured on *P. distichum*, *P. pubiflorum*, *P. floridanum*, and *P. intermedium*. All the species mentioned, except *P. dilatatum*, appear to be new hosts of the ergot fungus, from which *P. notatum* (narrow-leaved Uruguayan and common local strains), *P. lividum*, *P. malacophyllum*, and *P. supinum* remained immune in field trials. The sclerotia of *C. paspali* in the florets of *P. urvillei* were spherical to ellipsoid and measured 1 to 2 by 1 to 1·5 mm. compared with 3 to 4·5 mm. for the irregular, deeply ridged bodies occupying the same organs in *P. dilatatum* and *P. laeve*.

Schander (H.). **Untersuchungen über die Abhängigkeit der Jugendchlorose von Lupinus luteus von Aussenfaktoren in Sandkultur.** [Studies on the dependence of juvenile chlorosis in *Lupinus luteus* on external factors in sand culture.]—*Bodenk. u. PflErnähr.*, N.S., xii, 1–2, pp. 71–84, 1 fig., 8 diags., 2 graphs, 1939.

Continuing his studies on the environmental factors involved in the etiology of juvenile chlorosis of yellow lupins (*Lupinus luteus*) [*R.A.M.*, xviii, p. 257], the writer ascertained by means of sand culture experiments that the occurrence of the condition does not depend on the calcium content of the soil, or directly on the reaction of the latter as a whole, but solely on that prevailing in the vicinity of the root system. A preliminary experiment yielded data suggesting that the root secretions may consist of monopotassium phosphate, in which case they would be liable to precipitation by the presence of appreciable quantities of calcium carbonate in the surrounding medium.

It is evident from a perusal of previous literature on lupin chlorosis that the physiological constitution of older plants is entirely distinct from that of young ones, which alone show the typical symptoms of the lime-induced disorder.

Holz (W.). **Die Bedeutung der Beobachtung des Askosporenfluges von Fusicladium dendriticum für die Terminwahl bei den Vorblütenspritzungen. Vorläufige Mitteilung.** [The importance of the observation of the ascospore flight of *Fusicladium dendriticum* for the timing of pre-blossom spraying dates. Preliminary note.]—*NachrBl. dtsch. PflSchDienst*, xix, 4, pp. 29–31, 1 graph, 1939.

Pursuing his investigations in the Elbe Valley in 1938 on the apple scab (*Fusicladium dendriticum*) [*Venturia inaequalis*] ascospore discharge periods in relation to the timing of pre-blossom sprays for the control of the disease [*R.A.M.*, xviii, p. 462], the writer emphasizes the great importance of applying the prophylactic treatment before the main flight. In the experiments herein described the pre-blossom spray of 24th March (2 per cent. Bordeaux mixture) resulted in a yield of

51·1 per cent. sound fruits, whereas the 2 per cent. lime-sulphur application postponed until 24th April (after the close of the flight from 15th to 20th) produced only 15. The highest output (90·2 per cent.) of healthy apples was secured by four treatments (two pre- and two post-blossom), while the unsprayed controls yielded only 7·2 per cent.

HOLZ (W.). **Der Einfluss der März-Temperaturen auf die Geschwindigkeit des Reifungsvorganges von Venturia inaequalis-Perithezien.** [The influence of March temperatures on the rapidity of ripening of the perithecia of *Venturia inaequalis*].—*Angew. Bot.*, xxi, 2, pp. 209–214, 1 graph, 1939.

The author points out that in the control of *Venturia inaequalis* [see preceding abstract] it is of the utmost importance to apply the first spray before the beginning of ascospore discharge, the prediction of the probable date of which is therefore essential. From observations in Altenland (Lower Elbe), Germany, carried out over a period of seven years (1932 to 1938), the author found the average dates on which the perithecia ripened. Temperature aggregates, based on mean daily temperatures, were calculated for each year from the 1st or 15th of each month between November and April to the date of the ripening of the perithecia. It appeared that the temperatures before 1st March had no appreciable effect on the ripening of perithecia. From that date onwards until the perithecia ripened the mean day temperature aggregates were almost constant during the seven years, being on the average 105° C., whereas the temperature aggregates from earlier or later dates differed considerably in the various years. It is concluded that the sooner a mean day temperature aggregate of 105° is reached after 1st March, the sooner the perithecia will ripen. These results being admittedly valid only for the district under observation, it is suggested that similar calculations should be made for other fruit-growing areas.

MCKAY (R.). **Further spraying experiments for the control of Apple scab in 1937 and 1938, with some observations on the disease.**—*J. Dep. Agric. Éire*, xxxvi, 1, pp. 42–72, 11 figs., 1 diag., 1939.

In further spraying experiments against apple scab (*Venturia inaequalis*) in Éire [*R.A.M.*, xvii, p. 533] satisfactory control was obtained in 1937 and 1938 by three or four pre- and post-blossom applications of lime-sulphur or Bordeaux mixture, the latter being the better fungicide and giving more lasting protection to the foliage and fruit. Some injury to the foliage and russeting of the fruit was, however, observed on all trees sprayed with Bordeaux mixture. The disease was more easily controlled on trees sprayed regularly than on those untreated for several years, but thorough spraying effectively controlled the disease even when infected bud scales were present. It was found that wherever scab was prevalent on apple trees during the growing season infected bud scales were present during the following dormant season, providing conidia for initial infection of the foliage in the spring. The absence of infected buds in 1937 was equivalent in its controlling effect to three or four sprays. Tar oil washes applied during the dormant season had no effect on the control of the disease.

Petch (C. E.). **Evaluating orchard spray materials—a progress report.**—*Sci. Agric.*, xix, 7, pp. 424–434, 1939.

To determine whether it may be possible to estimate more exactly the true value of a fungicidal spray than is the case when only the reduction in the percentage of affected fruits is considered, the author carried out comparative spraying tests in Quebec from 1934 to 1937 on McIntosh apple trees, using lime-sulphur and calcium arsenate and other materials as applied under commercial conditions, and carefully observing the effects produced in relation to scab (*Venturia inaequalis*), russeting, end-burn, insect pests, windfalls, number of apples borne, weight of the harvested crop, trunk girth, terminal growth, bud size, and ash content of the foliage. The data obtained [which are tabulated] indicated that an increased yield may be correlated with increase in bud size, twig growth, and ash content of the leaves, and that differences in these may be due to the use of different fungicides. The materials employed in spraying should protect the tree and the fruit against disease while at the same time exerting no phytocidal action. In the author's opinion, the best criterion of the value of a spray is the weight of clean, marketable fruit given by the trees treated with it. The author's data and other experimental results show that in estimating the value of spray materials their effect on tree growth, foliage development, and total crop production should be considered, as well as the protection afforded to the fruit.

Boyd (O. C.). **Northwestern anthracnose of Apple reported from Massachusetts.**—*Plant Dis. Reptr*, xxiii, 7, pp. 125–126, 1939. [Mimeographed.]

In March, 1939, typical infections of north-western anthracnose (*Neofabraea malicorticis*), showing the 'guitar-string' fibres stretched across the old canker areas, were observed on inadequately sprayed Cortland and McIntosh apple trees [*R.A.M.*, xvii, p. 797] in Plymouth County, Massachusetts, this being apparently the first record of the disease for the State. The most severe damage arose from the 1937 cankers, those of 1938 being generally noticeable only as extensions of the previous season's infections.

Fresa (R.). **La presencia de 'Entomosporium maculatum', parásito del Manzano, en el Delta de Paraná.** [The presence of *Entomosporium maculatum*, a parasite of the Apple, in the Paraná Delta.]—*Rev. argent. Agron.*, vi, 1, pp. 53–56, 3 figs., 1939.

Attention is drawn to the detection, in December, 1937, of *Entomosporium maculatum* [the imperfect stage of *Fabraea maculata*: *R.A.M.*, xviii, p. 478], forming reddish, later dark chestnut, concentric lesions, 1·5 to 3 mm. in diameter, on apple foliage, this being the first record of the fungus on the host in question in the Argentine, where it has previously been reported, however, on pear and quince. The attack occurred on five- to seven-year-old apple trees, the Araucano variety being the most severely affected.

Miller (P. R.). **Incidence and importance of Quince rust on Apple as affected by environmental and developmental factors.**—*Plant Dis. Reptr*, xxiii, 5, pp. 80–82, 1 map, 1939. [Mimeographed.]

Four years' observations in Maryland, Virginia, West Virginia, North

Carolina, Georgia, and Pennsylvania showed that quince rust (*Gymnosporangium clavipes*) [*R.A.M.*, xvii, p. 400] has long been present in this area on members of the Rosaceae and species of *Juniperus*. Once established on the juniper this rust is perennial and may sporulate for twenty years. On apple, infection is confined to the fruits, which are susceptible only during a period of about twelve days, while small. The basidiospores are disseminated during a relatively short period, as compared with those of *J. juniperi-virginianae* [ibid., xviii, p. 321] and *G. globosum* [ibid., xvi, pp. 542, 618]. Apples do not become infected by *G. clavipes* unless the susceptible stage of development coincides both with basidiospore dissemination and a rainy spell. These limiting factors have probably checked the disease, which attains economic importance only when all these factors are favourable.

Scupin (Frl. L.). **Frischhaltung von Äpfeln mit Hilfe bestimmter Öle.** [Apple preservation with the aid of certain oils.]—*Obst- u. Gemüseb.*, lxxxv, 4, pp. 48–49, 1 fig., 1939.

Particulars are given of experiments at the Magdeburg (Germany) Co-operative Low Temperature Research Station on the treatment of Landsberg Renette and Beauty of Boskoop apples immediately after harvesting with three brands of oil (2252, 2253, and 2243) supplied by the firm Rhenania-Ossag, of which the last named caused injury to the fruit. After three, four, five, and six months storage (1937–8) at +1° C. the incidence of *Gloeosporium album* [*R.A.M.*, xvi, p. 820; xviii, p. 119] in the lots of Landsberg Renette treated with 2252 was 40, 62, 68, and 74 per cent., respectively, compared with 28, 46, 64, and 76 for 2253 and 52, 64, 70, and 72 for the controls. The corresponding figures for the same variety at —1° were as follows: 2252, 18, 42, 52, and 63 per cent., respectively; 2253, 18, 40, 51, and 52; and controls, 37, 53, 60, and 64. For Beauty of Boskoop at +1° the incidence of infection in the 2252-treated lots after the same periods was 0, 2, 4, and 4 per cent., respectively, compared with 0, 2, 8, and 10 for 2253 and 0, 6, 16, and 54 for the controls. The corresponding figures for the same variety at —1° were as follows: 2252, 0, 2, 4, and 8 per cent., respectively; 2253, 0, 0, 4, and 7; and controls, 0, 2, 11, and 43.

Hewitt (W. B.) & Leach (L. D.). **Brown-rot Sclerotinias occurring in California and their distribution on stone fruits.**—*Phytopathology*, xxix, 4, pp. 337–351, 3 figs., 1 map, 1939.

In addition to information already presented in a preliminary note [*R.A.M.*, xviii, p. 120], this expanded account of the writers' studies on the species of *Sclerotinia* concerned in the brown rot of stone fruits in California contains the following items of interest. *S. laxa* [ibid., xviii, p. 461] is believed to have been long present in the State and responsible for most of the infection described as brown rot in previous publications. It was widely distributed throughout the area surveyed (comprising the principal fruit-growing districts), whereas *S. fructicola*, which is probably of comparatively recent introduction, was more localized, occurring most abundantly in the Sacramento Valley. Both species have been isolated from blighted blossoms and twigs of peach, nectarine, apricot, and cherry, but *S. laxa* alone appears to attack almonds. In general,

S. laxa shows a preference for blossoms and twigs, whereas *S. fructicola* is mainly restricted to the fruits. In the San Joaquin valley most of the cultures of *S. fructicola* were derived from peach and nectarine, while almond and plum yielded *S. laxa*, which was also the only species developing from overwintered blighted stone fruit twigs producing 'sporodochia'.

Leach (L. D.) & Hewitt (W. B.). **Forced ejection of ascospores from apothecia of Sclerotinia species.**—*Phytopathology*, xxix, 4, p. 373, 1939.

The exposure of mature apothecia of *Sclerotinia sclerotiorum* and the brown rot fungi [*S. fructicola* and *S. laxa*: see preceding abstract], after two days in a moist chamber at 4° C., to the vapours exhaled by an aqueous solution of alcohol (41·7 per cent. by vol.), formalin (14·3), and acetic acid (14·3), was found to induce violent and repeated ascospore discharge. The vapours of alcohol alone and of alcohol and acetic acid exerted no appreciable effect, but formalin alone acted similarly to the combined fixative. A large percentage of the spores thus ejected proved capable of germination.

Bucksteeg (W.). **Untersuchungen über den Sporenflug bei Monilia als Grundlage für die chemische Bekämpfung. Vorläufige Mitteilung.** [Researches on the aerial distribution of *Monilia* spores as a basis for chemical control. Preliminary report.]—*Z. PflKrankh.*, xlix, 4, pp. 252–258, 2 graphs, 1939.

Spores of *Monilia* [*Sclerotinia* spp.: *R.A.M.*, xviii, p. 401] were found to be present in the air of two cherry orchards and one of pome fruits in the Lower Elbe district of Germany throughout the year. From the middle of August to the beginning of October only few spores were found, while great numbers were present from October to the beginning of December, again in April, and from the second half of May to early June. When mummified fruits were exposed, spores were produced freely on those left on the ground during rainy and warm days, whereas no spores were found on those stored in a dry and cool room; and while spores were formed on some of the fruits hung in bags on the tree, none developed on those covered by 2 to 3 cm. of soil, indicating that high temperature, humidity, and free ventilation are important factors in spore formation. Consequently the danger of infection is particularly great during the first warm days in spring. It is recommended, therefore, that a first spray should be applied when the buds begin to swell and a second just before the blossoms open, while a third and fourth should follow directly after petal fall, and two to three weeks after flowering, respectively.

Husz (B.). **Hazai adatok a csonthéjas gyümölesfák gombaokozta levélfoltosságaihoz. I.** [Data on the shot hole disease of stone fruit trees. I.]—*Bull. R. Hung. hort. Coll.*, v, pp. 23–39, 1 col. pl., 2 figs., 1939. [English summary.]

On account of its olive-green to brownish spores the fungus *Phyllosticta prunicola* [renamed *Phoma prunicola* by Wollenweber and Hochapfel: *R.A.M.*, xviii, p. 464] is transferred to *Coniothyrium* as *C.*

prunicolum [n. comb.]. It is the agent in Hungary of shot hole of apricot leaves and spotting of the fruits (small, greyish-white, brown-edged lesions), produces concentric spots with alternate brown and carmine-red zones on sweet cherry fruits, and also attacks the foliage of sweet and sour cherries, prunes, and almonds, this being the first record for Europe of *C. prunicolum* on the leaves of the last-named host. The pycnidia of the fungus measure 70 to 110 or up to 170 μ when provided with one pore, 260 by 220 μ when two to four are present, as in material examined from the almond, and the elliptical to ovate, rarely spherical conidia 3·6 to 8 by 2 to 3·6 (or up to 4·5) μ.

Particulars are given of a comparative study of *C. prunicolum* and *Clasterosporium carpophilum* (well known in Hungary on sweet and sour cherries, prunes, apricots, peaches, and almonds) in prune agar cultures.

The occurrence of *Phyllosticta beijerinckii* on apricot leaves is reported.

WILLISON (R. S.). **Brown rot of Peaches in transit and storage.**—*Sci. Agric.*, xix, 7, pp. 458–474, 6 graphs, 1939.

In experiments carried out in Ontario, Rochester and Elberta peaches from trees to which different fungicidal spray and dust treatments had been given were picked in the green, intermediate, and ripe stages, wrapped in tissue paper, packed in two-layer lugs, and dispatched in refrigerated trucks at temperatures of 45° to 50° F. to Winnipeg and Saskatoon (1,000 and 1,500 miles, respectively), other lots being sent to England via Montreal. The fruits were examined on arrival at their destination and at subsequent intervals, and duplicate lots were examined at corresponding times in Ontario.

While peaches picked in the riper stages were more susceptible to the development of brown rot (*Sclerotinia fructicola*) [*R.A.M.*, xviii, p. 190] than those picked in the green stage, the evidence showed that the use of suitable fungicides, combined with careful handling and storage at a suitable temperature, delayed the onset of the disease long enough to permit the shipping and marketing of fruits picked at a sufficiently ripe stage to be of good quality when sold. Later pickings were rather more susceptible to *S. fructicola* than fruits picked on earlier dates. While no treatment gave complete control, wettable sulphur sprays applied immediately before harvest gave more uniform results than those which had to be applied two or three weeks earlier. Sulphur dusting gave satisfactory control except when rain intervened between treatment and harvesting. The incidence of bruising, and of rots (due to *Rhizopus nigricans* and *Penicillium*, *Cladosporium*, and *Alternaria* spp.), was reduced by careful handling. When the packs were exposed to low temperatures within eight hours of picking, little or no rot developed until they were returned to higher temperatures, but when they were kept for an additional 24 hours before being cooled, brown rot was about as prevalent as in the lots not cooled at all. When the truck was iced only on departure, and not subsequently, the peaches from sprayed and dusted trees showed about as much brown rot as those from untreated trees.

Daxer (H.). **Versuche über die Wirkung des Kupfers auf Blätter.** [Experiments on the effect of copper on leaves.]—*Z.PflKrankh.*, xlix, 4, pp. 225–251, 10 figs., 1939.

In experiments with stone and pome fruits and berries in 1937–8 at Geisenheim, Germany, leaves were totally immersed for varying periods in copper solutions contained in waxed paper bags. When four neighbouring leaves of a potted peach tree were treated thus for 48 hours in a 0·35 per cent. solution of copper sulphate, several leaves and branches 20 to 40 cm. away from the enclosed leaves showed the presence of copper; in a similar experiment with a potted pear tree the presence of copper was established at distances of 1, 20, and 65 cm. from the treated leaves. These results show that the copper is absorbed by the leaf and conducted along the vessels. Injury was found to increase with temperature (small spots appearing at 5° C., marginal burns at 25°, and damage to almost the entire leaf at 34°), and was also more severe in wounded leaves than in unwounded. Copper solutions from 0·62 to 0·006 per cent. caused after a few hours or several days severe discoloration and eventual fall of treated leaves, and wilting and discoloration of leaves up to 1 m. from the bag, the injury spreading farther towards the tips of the branch than towards the bases. Sometimes the bark at the base of the enclosed leaf was also discoloured, torn, and sunken. Copper solutions of 0·003 to 0·0006 per cent. still damaged the enclosed leaves, but no injury was caused by solutions of 0·00025 per cent. The Silvan vine variety was more resistant to copper injury than the Le Lectier pear, the Grosse Lange Lot cherry being the least resistant. Copper solutions of 0·5 per cent. caused injury in one to two hours, while weaker solutions needed longer, 0·00125 per cent. being too weak to cause any injury at all in 24 hours. Since high concentrations of copper occur in the spray film, if at all, only for a few minutes before it dries up completely, it is concluded that copper injury to fruit trees would not result from normal spraying, except possibly in districts with much dew and fog.

The application of a leaf stalk injection method showed that 0·13 to 0·64 mg. of metallic copper caused severe injury to all fruit trees; 0·05 to 0·1 mg. caused moderately severe to severe injury to stone fruits but only slight injury to pomes; 0·025 mg. caused slight injury to stone fruits and scarcely any to pomes. It is suggested that the different degrees of resistance of stone and pome fruits to copper is based on differences in cell structure.

Hildebrand (E. M.). **Currant mosaic.**—*Phytopathology*, xxix, 4, pp. 369–371, 1 fig., 1939.

During the past four years a mosaic-like disease of red currants, typified by partial foliar chlorosis (sometimes unilateral), stunting, and gradual loss of productivity, has spread rapidly in a commercial planting in Ulster County, New York. Successful transmission of infection from diseased to healthy shoots was secured in three out of five inarch-grafting experiments, but budding and whip-grafting trials gave negative results. Cuttings from diseased plants failed in propagation tests, denoting a decline in vitality. Natural spread is presumably effected by insects, the identity of which has not yet been determined.

BLACKFORD (F. W.). **Virus diseases of the Strawberry.**—*Qd agric. J.*, li, 2, pp. 173–176, 1 fig., 1939.

Strawberries in Queensland are affected both by yellow edge and crinkle [*R.A.M.*, xviii, p. 402]; the former condition is more prevalent than the latter, though in one planting crinkle was so severe on an introduced variety that the plants were a complete loss. The most important varieties grown in Queensland, Phenomenal and Aurie, appear to be susceptible to both diseases, but it is thought that they can be controlled by roguing the diseased mother plants from the runner beds, the operation being commenced in winter. In Southern Queensland the symptoms of yellow edge and crinkle are much more pronounced in the cooler months than in the warmer ones, while at temperatures over 80° F. the symptoms of yellow edge became masked.

BEATTIE (R. K.) & CRANDALL (B. S.). **Disease attacks the Persimmon.**—*Amer. Forests*, xlv, 3, pp. 120–121, 124, 5 figs., 1939.

A semi-popular account is given of the *Cephalosporium* wilt of American persimmons (*Diospyros virginiana*), originating in Tennessee and shown by surveys in 1937 and 1938 to have spread to Mississippi, Alabama, Georgia, South Carolina, and Florida [*R.A.M.*, xvii, p. 539]. Preliminary inoculation experiments denote that *D. kaki*, grafted on *D. virginiana*, is also liable to contract the disease, and the fungus has further been shown to be pathogenic to *D. lotus*. Wilted trees are subject to rapid secondary infection by *Schizophyllum commune*, causing collapse within a few months. The possibilities of control by selection and hybridization are discussed. [An account of this work is also given by B. S. Crandall in *Plant Dis. Reptr*, xxiii, 4, pp. 56–58, 1 map, 1939.]

PESANTE (A.). **Sopra una malattia dell' Olivo sino ad ora sconosciuta.** [On a hitherto unknown disease of Olive.]—*Boll. Staz. Pat. veg. Roma*, N.S., xviii, 4, pp. 401–428, 2 col. pl., 17 figs., 1938 (issued April, 1939).

During the past few years olives in various parts of Italy have been affected by an apparently new form of branch withering and defoliation. Affected trees, showing bronzing of the foliage and defoliation at the extremities of the branches, occur in sparse groups among trees at first sight unaffected, but which closer inspection shows have already contracted the condition. In these more slightly affected trees a few leaves on the terminal twigs of one or two branches, or some of the leaves of a few suckers on the larger branches, are abnormally bright green and transparent in the terminal part, this area being distinctly separated from the normal distal part. The veins in the affected region are brown. In the more advanced stage, the leaf structure shows marked change, partial defoliation has taken place, and there is extensive leptonecrosis of the branches and frequently of the leaf veins. The affected leaves are thick, rigid, brittle, and light green to bronze or deep brown. Affected leaves or parts of leaves contain abnormally large amounts of starch. If a diseased branch is lightly shaken, the leaves sometimes readily fall. At this stage, the terminal part of the branch is bare, the middle shows affected leaves, and the proximal part carries apparently normal leaves. Gradually, the entire foliage becomes

involved; progressive necrosis of the cambium and phloem sets in, and trees so affected do not recover. Productivity is reduced, as the buds on the axils of the diseased leaves generally die; if they survive, the fruits are much dwarfed.

No parasitic organism or soil defect appeared to be associated with the condition, which, from the nature of the symptoms, would seem to be of virus origin.

[A condensed account of this work appears in *R.C. Accad. Lincei*, Ser. VI, xxix, 1, pp. 37–39, 1939.]

Kearns (H. G. H.) & Martin (H.). **The position of combined washes in the post-dormant spray programme. Part I. The physical properties of spray-fluids with special reference to post-dormant washes. Part II. The use of post-dormant combined washes in fruit crops.**—*Sci. Hort.*, vii, pp. 96–118, 1939.

In the first part of this paper the authors discuss the physical properties of spray fluids with special reference to the influence of spray supplements (wetters, spreaders, and penetrants) on retention of the spray by the sprayed surface, on the tenacity of the spray deposit, and on penetration. The methods by which sprays can be rendered suitable for over-spraying without serious loss of protective qualities or increase in phytocidal action are indicated, and it is shown that oil emulsions furnish the best basis for combined direct and protective insecticidal-fungicidal sprays, as they have, combined with insecticidal or fungicidal properties, good powers of penetration and wetting, with high retention and tenacity.

In the second part, notes are given on the chief materials used in post-dormant insecticidal-fungicidal washes, including copper- and rotenone-containing products, petroleum oil emulsions, ferrous sulphate, and water-soluble spreaders, and spray programmes are indicated for apples, plums, currants, and strawberries.

Heuberger (J. W.) & Horsfall (J. G.). **Relation of particle size and color to fungicidal and protective value of cuprous oxides.**—*Phytopathology*, xxix, 4, pp. 303–321, 1 graph, 1939.

In this study on the relation of particle size and colour to the fungicidal and seed- and foliage-protective values of cuprous oxide [*R.A.M.*, xviii, p. 332], particle size was measured by an adaptation of Wilcoxon and McCallan's technique, based on microscopic counts of the number of particles lying within a known area and a calculation of their weight from the concentration of material in the liquid and the volume of liquid for each square [ibid., xi, p. 386]. Fungicidal value (capacity for the inhibition of spore germination) was gauged by a modification of the same workers' slide-testing technique [ibid., xi, p. 730], using a precision sprayer depositing 0·000384 mg. of a 0·1 per cent. copper solution per sq. cm. per second on the cellulose nitrate-coated slides, the test fungus being a 21-day-old potato dextrose agar culture of *Macrosporium* [*Stemphylium*] *sarcinaeforme* [ibid., xviii, p. 141]. The protective value (ability to prevent plant tissue infection) of the various brands of cuprous oxide was tested against damping-off (mainly

Pythium ultimum) on Perfection pea seeds, definite amounts of the different samples being added to 100 gm. seed in Erlenmeyer flasks, which were rotated for ten minutes at 40 r.p.m.; the seed was then planted in soils of high damping-off inoculum potential [ibid., xviii, p. 332] in the greenhouse, climate laboratory (Johnson chambers) [ibid., vii, p. 531], and field. This factor was further measured in the field on rose and tomato foliage infected, respectively, by *Diplocarpon rosae* and *Alternaria solani*, using standard spraying methods.

The colour of cuprous oxide was found to be a function of the particle size, the normal range extending from acajou red at 2·57 μ mean diameter through orange Pompeian red (1·65 μ) to Mars yellow at 0·94 μ. The presence of black cupric oxide imparts a dark shade. The mean particle diameter of thermal cuprous oxide ranges up to 2·93 μ. The fungicidal and protective values of the cuprous oxide varied inversely with particle size, increasing with the graduation of the tone from red through orange to yellow. The apparent reduction of fungicidal and protective efficacy by the presence of cupric oxide in the preparations is thought to be due to the tendency of the compound to increase particle size and to the dilution of the cuprous oxide.

The probable explanation of the enhanced fungicidal and protective values of cuprous oxide of small particle size lies in the increase both in the area of chemically reactive surface per unit of weight and in the rate at which copper is presented to the germinating spore.

In connexion with the significance of laboratory tests in research on fungicides, it is of interest that the various brands of cuprous oxide occupied the same relation to each other in the field and greenhouse as in the laboratory trials, the yellow being much more effective than the red against the diseases under investigation.

Roach (W. A.). **Plant injection for diagnostic and curative purposes.**—*Tech. Commun. Bur. Hort. Plant. Crops, E. Malling*, 10, 78 pp., 46 figs., 1 graph, 1938. [Received June, 1939.] 5*s*. 0*d*.

In this monograph, work on plant injection in various countries is critically surveyed, and the different methods of injection with liquids, based on the author's own work, are described. The main purpose of these methods is stated to be the diagnosis of mineral deficiencies.

Warnes (A. R.). **Building materials. Their discoloration, decay, cleaning and reparation.**—*J. Clerk Wks Ass.*, lv, 666, pp. 154–157, 1938. [Abs. in *Build. Sci. Abstr.*, N.S., xi, 11, pp. 354–355, 1938.]

Recent researches appear to have thrown doubt on the theory that soot is the primary cause of discoloration of building materials, such as stone, brick, terra-cotta, and cement renderings [*R.A.M.*, xviii, p. 333]. An analysis of the soot from the main cornice of a large London building revealed, in addition to dust from miscellaneous sources, moulds and other types of micro-organisms. The water-soluble substances from this material produce yellow to reddish-brown stains on stone and brick-work. The incidence of decay of this nature may be considerably reduced by the use of pure water for washing instead of chemicals, such as caustic soda. Careful steam cleaning may also be utilized.

Quanjer (H. M.). **Nieuwe inzichten in den aard der voor planten pathogene viren.** [New glimpses into the nature of the phytopathogenic viruses.]—*Tijdschr. PlZiekt.*, xlv, 2, pp. 42–51, 1939.

A summary is given of some recent important contributions to the understanding of plant viruses, reference to all of which has been made from time to time in this *Review.*

Black (L. M.). **Inhibition of virus activity by insect juices.**—*Phytopathology*, xxix, 4, pp. 321–327, 5 graphs, 1939.

Juices of the insect vectors *Aceratagallia sanguinolenta*, *Aedes aegypti*, *Aphis rumicis*, *Eutettix tenellus*, *Macrosiphum pisi*, *M. solanifolii*, *Macrosteles divisus*, and *Myzus persicae* at a strength of 15·5 mg. per c.c. were experimentally shown by the half-leaf inoculation method to inhibit the infectivity of tobacco mosaic virus solution to Early Golden Cluster beans (*Phaseolus vulgaris*). Juices of macerated *Aceratagallia sanguinolenta* further inhibited the infectivity of plant juices containing the viruses of potato yellow dwarf [*R.A.M.*, xviii, p. 270], tobacco mosaic, turnip mosaic [ibid., xviii, p. 223], tobacco necrosis [ibid., xviii, pp. 348, 416], tobacco ring spot No. 1, and potato virus X, in inoculations on appropriate test plants with mixtures of insect juice and virus.

It was found that the infectivity of certain mixtures of tobacco mosaic virus and *A. sanguinolenta* juice can be increased by dilution or heat treatment. The inhibitor in the juice of this insect is thermolabile, dialysable only with difficulty, and unstable in acid or alkaline solution. If, as seems probable, the inhibitor is a protein, its activity is remarkable since 0·15 mg. of *A. sanguinolenta* juice, containing only about 0·0015 mg. soluble protein nitrogen, reduces the infectivity of 1 c.c. of a solution of tobacco mosaic virus by 50 per cent. The number of primary lesions in beans was reduced by an approximately constant percentage by a given concentration of the inhibitor in the presence of different concentrations of the tobacco mosaic virus. The latter, however, is not destroyed by the inhibitor, the separation of which from the infective principle in mixtures can be effected either by ultracentrifugation or ultrafiltration.

Bawden (F. C.) & Pirie (N. W.). **Plant viruses I: serological, chemical and physico-chemical properties.**—*Tabul. biol., Den Haag*, xvi, 4, pp. 355–371, 4 graphs, 1938.

Tables are presented showing the properties of plant viruses in crude infective sap, their serological reactions, activity of purified virus preparations, approximate weights of virus in 1 l. sap, analytical composition, precipitation and isoelectric points, inactivation by acid and alkali (P_H stability ranges), effect of enzymes, shape of virus particles, sedimentation constants, viscosity, specific volume and specific gravity, and ultra-violet absorption spectra of solutions of purified plant viruses.

Smith (K. M.). **Plant viruses II: virus diseases of plants.**—*Tabul. biol., Den Haag*, xvii, 1, pp. 25–71, 1939.

This is a synopsis in tabular form of the modes of transmission, insect vectors, differential hosts, principal symptoms on main hosts, distribution, control, and literary records of some 150 virus diseases of plants.

Moriyama (H.) & Ohashi (S.). **Minute body-forming protein of vegetable origin and its relation to viruses.**—*J. Shanghai sci. Inst.*, Sect. iv, 4, pp. 17–38, 1938. [Abs. in *Chem. Abstr.*, xxxiii, 11, p. 4288, 1939.]

Minute body-forming protein was obtained from normal cucumber, kidney bean [*Phaseolus vulgaris*], tomato, poplar, spindle tree [*Euonymus europaeus*], *Taraxacum officinale*, lettuce, and eggplant leaves, and from the petals of normal bindweed [*Convolvulus arvensis*] flowers by the method described in previous issues of the same publication for the isolation of vaccinia virus and phage protein. The minute bodies of the vaccinia virus protein are defined by the first-named author in *J. Shanghai sci. Inst.*, Sect. iv, 3, pp. 135–140, 1937 as (at P_H 7·4) 'micelles observable under an ultramicroscope' and (at P_H 5·4) as 'particles so large as to be observable under an ordinary microscope and unable to pass through a Berkefeld V filter, but definitely smaller than staphylococci'.

Endrigkeit (A.). **Das ernährungsphysiologische Problem der Mykorrhiza.** [The nutritional-physiological problem of the mycorrhiza]. —*Umschau*, xliii, 12, pp. 272–275, 9 figs., 1939.

The writer here concisely summarizes the results of his colorimetric studies on the nutritional and physiological interrelationships of mycorrhiza and their hosts in Germany, a more detailed account of which has already been presented from another source [*R.A.M.*, xvii, p. 407].

Romell (L. G.). **The ecological problem of mycotrophy.**—*Ecology*, xx, 2, pp. 163–167, 1 fig., 1939.

In discussing the nature of the symbiotic relation between conifers and their mycorrhizal fungi, the conclusion is drawn from the author's and other workers' observations that the obligate mycorrhizal fungi of conifers are unable to obtain adequate nitrogenous food from decomposing organic matter in the soil, but that they are vigorous parasites on their host trees. On the other hand, conifers are known to develop poorly in the absence of mycorrhizal fungi. It is believed that the hyphae of the mycorrhizal fungi serve the host tree by forming a highly efficient absorbing system, which requires less expenditure in assimilates on the part of the tree than a correspondingly efficient root system would have done, while the tree supplies the fungi with a source of energy particularly easily utilized.

Modess (O.). **Experimentelle Untersuchungen über Hymenomyceten und Gasteromyceten als Mycorrhizabildner bei Kiefer und Fichte. (Vorläufige Mitteilung).** [Experimental studies on Hymenomycetes and Gasteromycetes as mycorrhiza-producers on Pine and Spruce. (Preliminary note).]—*Svensk bot. Tidskr.*, xxxiii, 1, pp. 91–93, 1939.

In the writer's experiments at the Botanical Laboratory, Upsala, Sweden, on mycorrhizal synthesis between about 50 Hymeno- and Gasteromycetes and pine (*Pinus sylvestris* and *P. montana*) and spruce (*Picea abies*) seedlings in pure culture, using Melin's technique [*R.A.M.*, v, p. 245; xvi, p. 49], mycorrhiza were formed by *Amanita mappa* on all

three hosts, *A. muscaria umbrina* on all, *A. pantherina* on all, *A. rubescens* on *Pinus montana*, *Boletus flavidus* on all, *B. subtomentosus* on *P. montana*, *Clitopilus prunulus* and *Entoloma rhodopolium* on *P. sylvestris*, *Lactarius helvus* on all, *L. rufus* on *P. montana*, *Tricholoma albobrunneum*, *T. imbricatum*, and *T. pessundatum* on all, *T. vaccinum* and *Rhizopogon luteolus* on *P. sylvestris*, and *R. roseolus* on *P. sylvestris* and *P. montana*.

MELIN (E.) & LINDEBERG (G.). **Über den Einfluss von Aneurin und Biotin auf das Wachstum einiger Mykorrhizenpilze. Vorläufige Mitteilung.** [On the influence of aneurin and biotin on the growth of some mycorrhizal fungi. Preliminary note.]—*Bot. Notiser, 1939*, pp. 241–245, 1939.

Details are given of a series of preliminary experiments at Upsala, Sweden, in which the authors, following Fries's technique [*R.A.M.*, xviii, p. 335], tested the influence on the development of seven mycorrhizal fungi of aneurin, yeast filtrate, biotin, and inosit, added in appropriate concentrations to a synthetic (glucose-containing) medium at 25° C. The organisms responded by increased growth to the admixture of 1 γ aneurin or 1 mg. yeast filtrate with the culture solution, the excess of dry weight over the controls being in most cases substantial; thus after 25 days the weights of *Boletus elegans* [ibid., v, p. 246], *Clitopilus prunulus* [see preceding abstract], and *Rhizopogon roseolus*, stimulated with aneurin were about 10·6, 18, and 28·3 mg., respectively, compared with 1·5, 1, and 1·3 for the controls, the corresponding figures for yeast being 15·6, 15·5, and 31·4 mg., respectively. *Tricholoma albobrunneum* and *T. imbricatum* [loc. cit.] reacted more favourably to the yeast than to aneurin, producing 11·9 and 18·5 mg. dry weight, respectively, compared with 1·9 and 2·1 for the controls. Biotin (0·05 γ) and inosit (1 mg.), alone or jointly, failed to improve the growth of any of the fungi used in the tests, but in combination with aneurin both exerted a beneficial effect, the dry weights of *R. roseolus*, for instance, after 20 days being 16·4, 22·7, and 17·1 mg., respectively, for aneurin and biotin, aneurin and inosit, and all three together, compared with 11·2 for aneurin alone and 0·7 for the control.

ROBBINS (W. J.) & SCHMIDT (MARY B.). **Preliminary experiments on biotin.**—*Bull. Torrey bot. Cl.*, lxvi, 3, pp. 139–150, 1 graph, 1939.

The authors describe a method of estimating the biotin content of various substances [cf. *R.A.M.*, xviii, p. 268] by using as an indicator *Nematospora gossypii*, shown by Kögl and Fries to be unable to grow in the absence of small amounts of an accessory factor of the bios type [see preceding abstract]. The technique is based on data from the experiments of the above-mentioned workers. *Lophodermium pinastri*, another fungus with similar biotin requirements, was also used in some of the tests.

VANDENDRIES (R.). **Les multiples aspects de la sexualité dans le monde des champignons.** [The manifold aspects of sexuality in the realm of fungi.]—*Bull. Acad. Belg. Cl. Sci.*, Sér. 5, xxiv, 12, pp. 842–856, 1938.

This is a survey of the outstanding contributions to the knowledge

of the sex relationships of the Basidiomycetes appearing during the last twenty years. Reference has been made from time to time in this *Review* to those of the studies with a bearing on matters of phytopathological interest.

BALDACCI (E.). **Prime richerche di immunizzazione di organi isolati e tessuti vegetali in vitro. I. II.** [First researches on the immunization of detached organs and plant tissues *in vitro*. I. II.]—*Boll. Soc. ital. Biol. sper.*, xiv, 1, pp. 50–51, 1939.

Continuing his studies on plant 'vaccination' [*R.A.M.*, xvii, p. 197], the author describes a series of experiments, yielding only negative results, on the immunization by this method of the leaves of clover (*T*[*rifolium*] *pratense*) against *Macrosporium commune* [? *Stemphylium botryosum*] and *Rhizoctonia solani* var. *ambigua* (the 'toile' disease organism [ibid., xvii, p. 55]), and of maize roots against the latter fungus.

KAUSCHE (G. A.). **Zur Charakterisierung des Tabakmosaik- und Kartoffel-X-Virus mit der Goldsolreaktion.** [On the differentiation of Tobacco mosaic virus and Potato virus X by the gold sol reaction.]—*Biol. Zbl.*, lix, 3–4, pp. 194–221, 2 figs., 14 graphs, 1939.

From this amplified account of the writer's experiments in the differentiation of tobacco mosaic virus and potato virus X by means of their reactions to colloidal gold [*R.A.M.*, xvii, p. 832], it appears that the latter, at certain albumin concentrations, develops a voluminous red flocculation which is entirely absent from tobacco mosaic preparations. In addition to this phenomenon, known as the 'aggregation type' a blue flocculation ('nuclear type') may also be manifested by the potato virus.

KÖHLER (E.). **Über das Auftreten abweichender Varianten bei den Cs-Stämmen des Kartoffel-X-Virus.** [On the occurrence of aberrant variants in the Cs strains of Potato virus X.]—*Arch. ges. Virusforsch.*, i, 1, pp. 46–69, 7 figs., 1 diag., 1939.

The powerful strain Cs 36 of potato virus X [*R.A.M.*, xvii, p. 264] was readily induced to form an abundance of aberrant weak strains by heating the infective crude juice of diseased Samson Bashi Bagli stalked tobacco plants to the inactivation limit (66° C.), but the same procedure was ineffectual in the case of the relatively feeble Cs 35, which originally gave rise to Cs 36. The mutants developing from the homogeneous strains of Cs 35 and Cs 36 differ not only quantitatively, but also to some extent qualitatively, from their parents. So far, the strains derived from Cs A are classifiable in four groups according to the intensity of the symptoms produced in inoculations on tobacco. Two new variants of Cs 35, resembling but distinct from Cs 36, are named Cs 64/1 and Cs 64/2. The very powerful, slow moving Cs 37 differs from Cs 36 in the formation of a typical ring pattern instead of tortoise-shell. Cs 17, an aberrant strain of Cs 36, is closely allied to Cs 35 but has a longer incubation period.

The X-virus molecule is envisaged as composed of at least two parts, viz., a nucleus of specific constitution and one or more radicals

determining the intensity and nature of the pathological syndrome. Quantitative aberrations would thus depend on an increase or reduction in the number of the radicals, and qualitative on the substitution of one radical for another [cf. *R.A.M.*, xviii, p. 129].

STEVENSON (F. J.), SCHULTZ (E. S.), & CLARK (C. F.). **Inheritance of immunity from virus X (latent mosaic) in the Potato.**—*Phytopathology*, xxix, 4, pp. 362–365, 1939.

At least six strains of potato virus X, the agent of latent mosaic, are stated to be distinguishable by their reactions on potato and *Datura stramonium*. From all these S41956 was found to be immune in graft tests [*R.A.M.*, xvi, p. 630]. The mode of inheritance of the character conferring immunity was studied in crosses between S41956 and two non-immune varieties, Katahdin and Earlaine, in a progeny of S41956 selfed, and in the progenies of two other immunes, 774–67 and 792–114 selfed. The percentage of immunity in the two crosses and in the selfed lines were 37 and from 72 to 78, respectively, these results being explicable on the usual basis of autotetraploid inheritance. Genes A and B both being essential for immunity, the immune plants used as parents in these experiments are assumed to possess the genetic constitution AA aa Bb bb, the non-immune being expressed by the formula aa aa bb bb. The ratios computed on the foundation of this hypothesis fit the observed data reasonably closely, the deviation, divided by the standard error, in no case exceeding two.

STEVENSON (F. J.) & CLARK (C. F.). **The Sebago Potato, a new variety resistant to late blight.**—*Circ. U.S. Dep. Agric.* 503, 6 pp., 2 figs., 1938. [Received June, 1939.]

During the last seven years the Sebago potato variety, derived from a cross between Chippewa and Katahdin, has proved to be moderately resistant to late blight (*Phytophthora infestans*) [*R.A.M.*, xviii, p. 271] and highly so to mild mosaic [ibid., xviii, p. 411] in field tests in Maine and (in 1937 only) in five counties of New York State. The new variety is fairly prolific and produces tubers of superior quality, so that it may well be of considerable value in late potato-growing sections where blight cannot be effectively combated by spraying.

SYRE (H.). **Versuche zur Bekämpfung von Schorf und Rhizoctonia durch Beizung und Bodendesinfektion.** [Experiments in the control of scab and *Rhizoctonia* by steeping and soil disinfection.]—*Pflanzenbau*, xv, 9, pp. 346–360, 6 figs., 3 graphs, 1939.

The results [which are fully tabulated and discussed] of preliminary experiments in the control of potato scab [*Actinomyces scabies*] and *Rhizoctonia* [*Corticium solani*] at Stendal [near Magdeburg, Germany] by tuber-steeping and soil disinfection (separately and in combination) [*R.A.M.*, xvii, p. 835] showed that, generally speaking, the outcome of tuber treatment was too unreliable to justify the recommendation of this method of control, but in cases of mild tuber and soil infestation a degree of protection may be secured by three minutes' immersion in 0·2 per cent. aretan or sprinkling with the same preparation at 1 per cent. *C. solani* was, however, very effectively combated and yields sub-

stantially increased (up to 27 per cent.) by soil treatment with a mixture of superphosphate and the organic mercury preparations P_1 and P_2 (I. G. Farben) at the rate of 200 kg. per hect., the incidence of diseased tubers being reduced from 34 per cent. in the controls to 15 and 16 per cent. respectively, and scab attack declining from 87·4 per cent. (by weight) for the untreated tubers to 23·3 and 20·2 per cent., respectively.

DEML (H.). **Weitere Kartoffelbeizversuche mit Aretan.** [Further Potato disinfection experiments with aretan.]—*Ratschl. Haus, Garten, Feld,* xiv, 4, pp. 51–54, 2 figs., 1939.

Details are given of an experiment in the control of *Rhizoctonia* [*Corticium*] *solani* on Fridolin potatoes in swampy ground in the Danube Valley, Bavaria, by means of tuber disinfection with aretan [see preceding abstract]. Half of each of three plots was planted with treated and half with untreated tubers; the yield of the former was 186·2 and that of the latter 159·7 kg. In another test on sandy clay five plots of treated tubers produced a harvest of 439·5 kg., the corresponding figure for the untreated being 431·5.

VAN SCHREVEN (D. A.). **De gezondheidstoestand van de Aardappelplant onder den invloed van twaalf elementen.** [The influence of twelve elements on the growth of the potato.]—*Meded. Inst. Phytopath. Wageningen,* 84, 166 pp., 30 pl., 2 graphs, 1939. [English summary.]

Part of the information in this exhaustive treatise, supplemented by a 15-page bibliography, on the influence of a deficiency or excess of twelve important nutrient elements on the condition of potato plants has already been noticed from other sources [*R.A.M.*, xv, p. 253; xviii, p. 269], but anatomical studies on the effects of the various elements are here described, together with experimental observations on the effects of iron, zinc, sodium, and chlorine, in varying concentrations on some well-known commercial varieties. Attention is drawn to the simulation of primary leaf roll symptoms in plants suffering from phosphorus, zinc, or boron deficiency. True leaf roll, however, may be differentiated from nutritional disorders by phloem necrosis, in which the dead sieve-tubes react to phloroglucin and hydrochloric acid by a red coloration absent from the disorganized tissues of plants affected, for instance, by lack of boron. In severe cases of boron deficiency, moreover, the damage is not restricted to the phloem, as it invariably is with leaf roll. Medullary necrosis [ibid., xvi, p. 118], due to calcium deficiency, is stated to occur sporadically in Holland.

MARTIN (A. L.). **Possible cause of black kernels in Rice.**—*Plant Dis. Reptr,* xxiii, 5, pp. 83–84, 1939. [Mimeographed.]

The defect of rice known as 'black kernel' [*R.A.M.*, xvi, p. 490] is most prevalent in the United States on the Fortuna and Rexoro varieties, though virtually all commercial varieties are susceptible. The affected kernels cannot be detected before milling and their removal before marketing may involve considerable expense. Isolations from some 1,200 affected kernels sterilized externally with mercuric

chloride solution (1 in 1,000) most frequently yielded *Curvularia lunata* [ibid., xvi, p. 771, and above, p. 517], though occasionally *Helminthosporium oryzae* [*Ophiobolus miyabeanus*], *Fusarium* sp., *Trichoconis caudata* [ibid., xvi, p. 490], and *Nigrospora* were also obtained. In field tests, dusting rice plants during flowering with pulverized black kernels gave 23 per cent. discoloured kernels in the mature grains; dipping blossoming heads of rice into an aqueous suspension of *C. lunata* spores gave 10·7 per cent. of black kernels. After harvesting, seeds from these dipped heads were incubated in a moist chamber for two weeks at 35° C., this treatment raising the percentage of black grains to 12·9 per cent. of the total grains. Though several organisms, which were neither pathogenic nor discolouring agents, grew over many of the seeds, *C. lunata* appeared in 67 out of 210 instances when black grains obtained by these treatments were cultured. Inoculations of rice seeds and seedlings with cultures of other fungi from discoloured kernels did not give rise to symptoms of black kernel. These results indicate that *C. lunata* may be the cause of black kernel disease of rice.

TOCHINAI (Y.) & KOMIYA (S.). **Studies on the infection of Piricularia oryzae Br. et Cav. on maltreated Rice plants.**—*J. Fac. Agric. Hokkaido Univ.*, xliv, 2, pp. 33–76, 1939.

When rice plants of a susceptible and a resistant variety were artificially infected with blast (*Piricularia oryzae*) [*R.A.M.*, xvii, p. 836; xviii, p. 272] after pricking, cutting, or bruising the leaves, or after exposure to drought for three to six days, to the vapour of ether, chloroform, or absolute alcohol, or to high atmospheric temperature, the treated plants developed a higher percentage of infection than the inoculated, untreated controls. Infection tended to be reduced, however, by exposure to a saturated atmosphere for periods up to 72 hours before inoculation.

DE FLUITER (H. J.). **Helicobasidium compactum Boedijn als parasitaire wortelschimmel van Hevea brasiliensis.** [*Helicobasidium compactum* Boedijn as a parasitic root fungus of *Hevea brasiliensis*.]—*Bergcultures*, xiii, 13, pp. 392–398, 4 figs., 1939.

Attention is drawn to the sporadic occurrence in Java of *Helicobasidium compactum* [see above, p. 503] in a severely parasitic form on rubber (*Hevea brasiliensis*) roots [*R.A.M.*, xvi, p. 160], and an account is given of three attacks of the fungus on the same estate in 1935, 1938, and the beginning of 1939. On the last-named occasion many lateral roots were found to have died back, the necrotic tissues being sharply delimited from the healthy and covered with a brown fungal network and numerous minute points, which were shown by microscopic examination to be the 'pseudosclerotia' of *H. compactum* as described by Boedijn and Steinmann [ibid., ix, p. 562]. In a dry state the roots were traversed by the typical chocolate-brown, purple-shot mycelium of the fungus. Adventitious roots were formed freely at the junction of diseased and sound tissues. Sparse crowns and shrivelled branches were features of trees with a badly infected root system. Control measures, on the usual lines of stringent sanitation of diseased plantations, are briefly indicated.

Bibliography of references to the literature on the minor elements and their relation to plant and animal nutrition. Third Edition.—488 pp., Chilean Nitrate Educational Bureau, Inc., 120 Broadway, New York, and the Nitrate Corporation of Chile Limited, London, 1939.

The present edition of this annotated bibliography of the literature on the relation between minor elements and plant nutrition, originally compiled by L. G. Willis [*R.A.M.*, xvi, p. 276], has been enlarged to include papers on animal nutrition, and now contains 4,628 abstracts and references.

Teakle (L. J. H.) & Stewart (A. M.). **Response to copper as a fertilizer on certain soils in Western Australia.**—*J. Aust. Inst. agric. Sci.*, v, 1, pp. 50–53, 1939.

In experiments commenced in 1937 in the Albany district of Western Australia the application to an acid black muck soil of a mixture containing copper, manganese, zinc, and magnesium sulphates, each at the rate of 20 lb. per acre, in addition to a 'complete' fertilizer, resulted in a 40 per cent. increase in yield of potatoes. The succeeding oats and potato crops also showed a marked response to the residues of the minor elements, primarily to copper [cf. *R.A.M.*, xvii, p. 508]. During 1938 satisfactory results were achieved on a variety of crops and soil types with copper sulphate dressings ranging from 8 to 15 lb. per acre, while most of the crops did not grow at all on undressed soils. In experiments with duplicated plots of 0·43 acre each on various types of soils the lateritic gravelly sands at Wagin responded best to copper (applied as sulphate), while other minor elements had no appreciable effect. Nabawa wheat grown on copper treated plots of clean fallow throve, had strong roots and well-formed heads, and matured normally, while plants on plots treated with other elements exhibited poor growth and failed to mature. The yield on the copper-treated plot was equivalent to over 25 bush. per acre, though this soil type had failed to mature a crop in the last 20 years. Copper in combination with manganese and zinc was not superior to copper alone.

Teakle (L. J. H.) & Morgan (E. T.). **Recent experiments with 'minor' elements in Western Australia. I. A brief review of the 'minor' element question in Western Australia. II. Experiments with 'minor' elements on the growth of Potatoes, vegetables, and pastures.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xvi, 1, pp. 116–128, 5 figs., 1939.

In the first of these papers, L. J. H. Teakle briefly touches on the question of the deficiency of Western Australian soils in minor elements, and adduces various examples of important responses brought about locally by applications of copper [see preceding abstract], manganese, zinc, and cobalt. In the second paper, the authors describe experiments made with minor elements, the [tabulated] results of which indicated that on marly peat soils of coastal swamps in the Albany district manganese sulphate applications will probably prove beneficial to potatoes, runner beans [*Phaseolus multiflorus*], cabbages, swedes, turnips, peas, and tomatoes; copper, in addition to manganese,

may prove beneficial on these soils to peas, swedes, and cabbages. On acidic soil types (including swamp soils, soils of bottle brush [*Callistemon*] flats, and brown, sandy soils of karri [*Eucalyptus diversicolor*] hills of the Albany district) copper was of great value to truck crops, potatoes, and pastures. It would appear to be unnecessary to use copper sulphate or manganese sulphate at rates of over 15 lb. per acre.

HEIM (R.) & BOURIQUET (G.). **Maladies et champignons du Giroflier à Madagascar.** [Diseases and fungi of the Clove in Madagascar.] —*Rev. Path. vég.*, xxvi, 1, pp. 5–35, 3 pl., 9 figs., 1939.

Clove 'apoplexy' [*R.A.M.*, xvi, p. 340] appears to have been present in Madagascar for over 30 years. No severe outbreak has occurred since 1907, in spite of the planting, between 1924 and 1926, of over 1,000,000 clove trees in one area alone. Trees under six or over ten years old are unaffected. The highest proportion of trees found affected in any plantation was 1 in 30, the figure in most cases ranging from 1 in 200 to 1 in 1,500. Only isolated trees are attacked, though the condition may affect several trees in the same straight line. Trees from seed fallen from diseased ones grow up unaffected in the same soil as the parent. In every case examined, the extremities of the pivotal roots of trees killed by the condition were found to be in close proximity to pieces of stone, and it is thought that the disease is physiological in origin. It is unlikely that the condition is the same as the 'sudden death' of cloves in Zanzibar [ibid., xvii, p. 626], which may be identical with the true root rot affecting cloves in Madagascar [ibid., xvi, p. 341].

The first symptom of clove apoplexy is a sudden wilting and discoloration of the leaves of a single tree, or of a few isolated ones, the rest of the plantation remaining unaffected. In less than a fortnight, defoliation is all but complete. Meanwhile, the branches start to wither, and death rapidly ensues. Very occasionally, only part of a tree may at first be affected.

Further details are given of the true root rot previously recorded [loc. cit.] and anthracnose (*Mycosphaerella caryophyllata* n. sp.) [loc. cit.]. The latter is very prevalent in Madagascar, causing orbicular, cream-coloured spots with reddish-brown peripheries, 4 to 16 mm. in diameter, on which are borne the perithecia with asci 50 to 68 by 13 to 17 μ, narrowing to 7 to 9 μ in the thick-walled upper portion, and unequally uniseptate ascospores, 21 to 27 by (for the larger of the two cells) 4 to 4·7 μ. *Cephaleuros virescens*, sooty moulds, and various saprophytic fungi on cloves are also recorded.

HOERNER (G. R.). **Hop anthracnose.**—*Plant Dis. Reptr*, xxiii, 7, pp. 123–124, 1939. [Mimeographed.]

Details are given of the herbarium specimens of hop anthracnose from various parts of the United States examined since the publication of a recent note on the disease, in which the causal organism is identified as the conidial stage of *Glomerella cingulata* [*R.A.M.*, xvii, p. 703]. In the writer's opinion the fungus should be classed, pending the detection of the perfect stage, among the Fungi Imperfecti; probably all the hop leaf spots hitherto reported under the name of anthracnose are due to *Colletotrichum humuli* Dearness.

Cane disease situation in the Bundaberg district.—*Aust. Sug. J.*, xxx, 12, pp. 737–738, 1939.

In a report on the present status of Fiji disease and downy mildew of sugar-cane [*Sclerospora sacchari*] in the Bundaberg district of Queensland [*R.A.M.*, xviii, p. 274], the Director of the Bureau of Sugar Experiment Stations states that the former was observed on 82 farms and four plantations during the past year. Nearly all the diseased fields are occupied by the susceptible P.O.J.2878 variety. P.O.J.2725 and 2714 are also highly susceptible, and occasional infection of M.1900 S[eedling] has further been noted in the older diseased areas. D.1135, though susceptible, was not found to be infected during the period under review. Co.290, P.O.J.213, and P.O.J.234 are highly resistant to Fiji disease, and Q.813, Oramboo, and Korpi reasonably so. Downy mildew is reported to have increased at an alarming rate, occurring on 98 farms and four plantations, chiefly on P.O.J.2878 and 213. D.1135 and P.O.J.234 are moderately susceptible, and P.O.J.2725 and Co.290 fairly resistant, to *S. sacchari*. A considerable amount of downy mildew has been observed on maize, and investigations are in progress at Brisbane to determine the relationship of the strains on this host and sugar-cane.

VIENNOT-BOURGIN (G.). **Contribution à l'étude de la flore cryptogamique du bassin de la Seine. 14e Note. A propos de deux Uromyces parasites des Légumineuses: Uromyces briardi Hariot et Uromyces anthyllidis (Grev.) Schroet.** [A contribution to the study of the cryptogamic flora of the Seine basin. 14th Note. On two *Uromyces* parasitic on Legumes: *U. briardi* Hariot and *U. anthyllidis* (Grev.) Schroet.]—*Rev. Path. vég.*, xvi, 1, pp. 66–92, 3 pl., 1939.

In comparative studies on *Uromyces briardi* and *U. fabae*, both found on *Vicia angustifolia* near Grignon, Paris, the author found that the uredospores of the former were usually globular, sparsely echinulate, and measured 20·3 to 26·1 by 15·9 to 23·2 μ, whereas those of the latter were often (more than 30 per cent.) ovoid or long ovoid, smooth, and 21·7 to 30·5 by 15·9 to 24·6 μ. From observations made on *U. anthyllidis* [*R.A.M.*, i, p. 34] found on *Medicago maculata* at Grignon, and from herbarium material on leguminous plants he concludes that the characters of this species are as follows: globular or subglobular uredospores with a brownish epispore 2·8 to 4 μ thick; 3 to 8 germ pores, almost always visible; globular ovoid, occasionally angular teleutospores with a brown, opaque epispore 1·8 to 4 μ thick, distinctly verrucose, with conical protuberances squat at the base, with a germ pore covered with a brownish papilla of verrucose folds. On this basis the following fungi, among others listed, are included in the species, viz., *U. trigonellae* on *Trigonella foenum-graecum* [ibid., xii, p. 660], *U. renovatus* on *Lupinus* [ibid., xvi, p. 207], and *U. ciceris-arietini* on *Cicer arietinum* [ibid., ix, p. 204]. Evidence was obtained from glasshouse experiments that *U. anthyllidis* on *M. maculata* is specialized to *Medicago* and the form of the fungus on this host is therefore named *U. anthyllidis* f. *medicaginis*.

NATTRASS (R. M.) & PAPAIOANNOU (P.). **Additions to a first list of Cyprus fungi.**—*Cyprus agric. J.*, xxxiv, 1, pp. 25–29, 1939.

This additional list of Cyprus fungi [cf. *R.A.M.*, xvii, p. 346] collected up to May, 1938, comprises 33 species. A host index is appended.

WATERSTON (J. M.). **Annotated list of diseases of cultivated plants in Bermuda.**—x+36 pp., Govt. Printer, Hamilton, 1939.

An annotated list is given of the diseases of plants cultivated in the Bermudas, arranged under hosts, followed by a check list of the fungi and bacteria involved, the virus diseases, and the non-parasitic diseases. Of the 251 diseases listed 200 are due to fungi, 19 to bacteria, 18 to viruses, and 10 to non-parasitic causes. A bibliography of 37 titles is appended.

MAIRE (R.) & WERNER (R. G.). **Catalogue raisonné des champignons connus jusqu'ici au Maroc.** [An annotated list of the fungi hitherto recognized in Morocco.]—*Mém. Soc. Sci. nat. Maroc.*, xlv, 148 pp., 1937 (issued 1938).

An annotated list is given of the 1,242 species of fungi recognized up to the date of compilation in French Morocco; 100 are peculiar to the country, 30 new to science [with Latin diagnoses], and 238 new records for Morocco [cf. *R.A.M.*, xvii, p. 507]. Among the items not already noticed from other sources may be mentioned *Asterocystis radicis* on flax [ibid., xvii, p. 654; xviii, p. 483]; *Peronospora arborescens* on poppies (*Papaver hybridum*, *P. rhoeas* [ibid., xviii, p. 140], *P. dubium*, and *P. setigerum*); *Peronospora spinaciae* on spinach [ibid., xviii, p. 275]; *Taphrina deformans* on almond and peach [ibid., xvii, p. 585 *et passim*]; *Microsphaera alphitoides* (*M. alni* f. *quercina*) [*M. quercina*] on oaks (*Quercus faginea* and *Q. pyrenaica*) [ibid., xvii, p. 438]; *Guignardia bidwellii* on vines; *Mycosphaerella sentina* on pear leaves [ibid., xvi, p. 191]; *Ophiobolus graminis* on wheat, barley, and *Phalaris canariensis*; *Polystigma rubrum* on almond [ibid., xvi, p. 392]; *Gibberella saubinetii* on *Asparagus albus*; *Claviceps purpurea* on *Avena jahandeiezii*, *Haynaldia hordeacea*, and *Festuca arundinacea*; *Lophodermium pinastri* on fallen pine needles; *Rhytisma acerinum* [ibid., xv, p. 184] and *R. salicinum* [ibid., xv, p. 259] on *Acer monspessulanum* and *Salix purpurea* foliage, respectively; *Pseudopeziza medicaginis* on living lucerne leaves [ibid., xviii, p. 397]; *Ustilago avenae* on cultivated and wild oats; *U. bromivora* [ibid., xvii, pp. 505, 618] on six species of *Bromus*; *U. hordei* on barley and *Elymus caput-medusae*; *U. tritici* on wheat; *U. zeae* on maize; *Sphacelotheca reiliana* [*Sorosporium reilianum*] on sorghum [see above, p. 517] and *Sorghum halepense*; *Tilletia levis* [*T. foetens*] and *T. caries* on wheat, the former also on *Triticum durum*; the aecidia of *Coleosporium inulae* on *Pinus halepensis* [ibid., viii, p. 210]; *Gymnosporangium confusum* on *Juniperus phoenicea* (aecidial stage on quince [ibid., xi, p. 145] and *Crataegus monogyna*); *G. oxycedri* on *J. oxycedrus* [ibid., ix, p. 754] (*C. monogyna*); *Puccinia allii* on *Allium* spp. [ibid., xvi, p. 563] including leeks; *P. coronata* on *Avena sterilis* and *Rhamnus oleoides*; *P. glumarum* on wheat, *T. durum*, barley, and rye; *P. helianthi* on sunflower; *P. simplex* [*P. anomala*] on barley, *Hordeum bulbosum*, and *Ornithogalum umbellatum* var. *longibracteatum*;

P. malvacearum on hollyhock [ibid., xv, pp. 109, 776] and other Malvaceae; *P. maydis* on maize; *P. menthae* on cultivated peppermint (*Mentha piperita*) [ibid., xvii, pp. 485, 771], and other Labiatae; *P. purpurea* on sorghum [see above, p. 517]; *P. triticina* on wheat; *Stereum hirsutum* on oaks (*Q. ilex, Q. faginea,* and *Q. coccifera*) and *Acacia retinodes*; *Fomes fomentarius* [ibid., xviii, p. 361] on poplar; *Ganoderma applanatum* on orange [ibid., xv, p. 16]; *Phyllosticta* [*Ascochyta*] *rabiei* on chick pea [ibid., xvii, p. 501]; *Phoma omnivora* on lemon fruits; *Macrophoma* [*Macrophomina*] *phaseoli* on broad and French beans [*Vicia faba* and *Phaseolus vulgaris*], spinach, maize, and carrots; *Septoria antirrhini* on *Antirrhinum majus* leaves [ibid., xvi, p. 563]; *S. apii* on celery; *S. graminum* on oats, wheat, *Poa annua*, and *Aira caryophyllea* [ibid., xviii, p. 297]; *Marssonina juglandis* [*Gnomonia leptostyla*:, [ibid. xvii, p. 654] and *Microstroma juglandis* [ibid., xvi, p. 642] on walnut (*Juglans regia*); *Helminthosporium sativum* on barley; and *Cercospora beticola* on beet.

FAULL (J. H.). **The biology of rusts of the genus Uredinopsis.**—*J. Arnold Arbor.*, xix, 4, pp. 402–436, 1938.

Species of *Uredinopsis* are known to pass through their diploid phase on one genus (*Osmunda*) of the Osmundaceae and on twelve of the Polypodiaceae, while the haploid stage occurs in nature, or has been obtained in culture, on *Abies alba, A. balsamea, A. firma, A. grandis, A. mayriana,* and *A. sachalinensis.* The life-histories of 16 of the 25 recognized *U.* spp. have been demonstrated by cultural studies at the Arnold Arboretum, details of which are here presented in connexion with *U. ceratophora, U. longimucronata, U. mirabilis* [*R.A.M.*, xiv, p. 482], *U. osmundae, U. phegopteridis,* and *U. struthiopteridis.* Teleutospores have been observed in all the known *U.* spp. except *U. investita* and *U. mayoriana.* The formation of these organs may begin as early as midsummer, nutritional rather than seasonal factors probably being concerned in the inception of the process. The teleutospores overwinter in dead infected fronds and become viable in the following spring.

Incidental evidence (requiring further confirmation) is forthcoming in support of the view that all or most *A.* spp. are liable to contract infection by all *U.* spp., though the latter have been shown by W. P. Fraser (*Mycologia*, vi, pp. 25–28, 1914) and the author to be strictly specialized in respect of their fern hosts. For instance, in the present investigations, the pathogenicity of *U. struthiopteridis* was restricted in cross-inoculations to *Matteuccia struthiopteris*, that of *U. mirabilis* to *Onodea sensibilis*, of *U. longimucronata* to *Athyrium angustum*, of *U. phegopteridis* to *Dryopteris linnaeana*, and of *U. osmundae* to *Osmunda claytoniana.* The last-named rust was found to comprise two physiologic races, one infecting *O. claytoniana, O. regalis* var. *spectabilis*, and *O. cinnamomea* and the other attacking the first two only.

Both firs and ferns sustain appreciable economic damage from *Uredinopsis* infection.

MAINS (E. B.). **Scopella gen. nov. of the Pucciniaceae.**—*Ann. mycol., Berl.*, xxxvii, 1–2, pp. 57–60, 1939.

The author erects a new genus, *Scopella* [with a Latin diagnosis],

characterized by subcuticular, hemispherical pycnidia; subepidermal pulverulent uredosori; brown, pedicellate uredospores, arising in groups from free cylindrical cells; subepidermal teleutosori; and unicellular, pedicellate, very thin-walled, hyaline teleutospores produced in the same way as the uredospores. The type species is *S. echinulata* (Niessl) n. comb. (*Uromyces echinulatus*), while *S. sapotae* (Arthur & Johnston) n. comb. (*Uredo sapotae*), found by the writer on *Achras sapota* in British Honduras in 1936, had previously been observed on the same host in the Bahamas, Dominica, and Cuba.

Kochman (J.). **Przyczynek do znajomości flory głowni polskich** (II). [A contribution to the knowledge of Polish smut fungi (II).]—*Acta Soc. Bot. Polon.*, xvi, 1, pp. 53–67, 2 figs., 2 pl., 1939.

In this further contribution to the study of smuts in Poland [*R.A.M.*, xvi, p. 62] nine species are discussed, bringing the total number of records up to 142 species. *Tuburcinia avenae-elatioris* n.sp. on *Avena elatior* [*Arrhenatherum avenaceum*] shows a strong morphological resemblance to *T. agropyri* but in inoculation experiments did not infect the latter's host *Triticum* [*Agropyron*] *repens*, while *Tuburcinia* [*Urocystis*] *agropyri* did not infect *Arrhenatherum avenaceum*. The author erects a new genus *Glomosporium* on the basis of *Tolyposporium leptideum* from *Chenopodium album*, and includes it in the Tilletiaceae.

Voorhees (R. K.). **The validity and morphology of two Tryblidiella species.**—*Mycologia*, xxxi, 2, pp. 113–123, 4 figs., 1939.

The author recognizes *Tryblidiella fusca* and *T. rufula* [*R.A.M.*, xii, p. 790] as two distinct species on the basis of the morphological characters of the ascocarps. Each produced pycnidia and spermogonia in culture but not in nature, and the general character and appearance of the pycnospores were similar to those of the genus *Diplodia*, though neither species showed markings on the spores corresponding to those of *D. natalensis*. It is considered remarkable that the pycnidial forms of such widely separated genera as *Tryblidiella* and *Physalospora* should be referred to the same form genus, *Diplodia*, and it is suggested that a more thorough study of these pycnidial forms may reveal sufficient differences to separate the imperfect species generically.

Tai (F. L.) & Cheo (C. C.). **Notes on Chinese fungi VIII.**—*Bull. Chin. bot. Soc.*, iii, 1, pp. 53–69, 2 pl., 1937. [Received June, 1939.]

Included in this annotated list of 46 Chinese rusts are eleven new species (with Latin diagnoses). *Phragmidium shensianum* n.sp., occurring on raspberries, is characterized by orange-yellow uredosori, $\frac{1}{3}$ to $\frac{1}{2}$ mm. in diameter, numerous cylindrical or clavate, suberect to incurved, hyaline paraphyses, subglobose or ovate, sparsely verrucose, pale yellow uredospores, 20 to 24 by 15 to 21 μ, with 3 to 5 germ pores, black teleutosori, 0·5 to 1 mm. in width, and cylindrical, pale yellow 4- to 8-, commonly 6- or 7-, rarely biseptate teleutospores, 51 to 115 by 31 to 36 μ (average 103 by 32 μ), with a blunt, pale yellow apiculum, 3 to 14 μ in height, a densely verrucose, chestnut-brown epispore, and a hyaline to faintly tinted pedicel, up to 167 μ in length and 14 to 21 μ in breadth at the base. Among the other records may be mentioned

P. rubi-parvifolii on raspberry, and *Uromyces fabae* on broad beans and *Vicia unijuga*.

McAuliffe (H. D.), Farrell (M. A.), Haley (D. E.), & Reid (J. J.). **A study of the epidemiology of Tobacco wildfire.**—Abs. in *J. Bact.*, xxxvii, 2, p. 234, 1939.

The incidence of tobacco wildfire in an epidemiological survey in Pennsylvania was found to be unrelated to that of *Phytomonas tabaca* [*Bacterium tabacum*: *R.A.M.*, xvii, pp. 353, 712, 732], which was present in all the plants examined whether or not they showed external evidence of disease. Normal tobacco of the cigar-leaf filler type was observed to be highly resistant to infection of economic severity during the growing period. Such plants contain a nitrogen-potassium ratio of somewhat less than one. Relative susceptibility, on the other hand, was exhibited by plants with a ratio exceeding one. During the ripening phase, susceptibility to wildfire may be acquired, regardless of previous nutrition, if any considerable amount of nitrogen is absorbed; this type of liability to the disease is increased by topping and suckering. Wildfire control would thus appear to be largely a matter of judicious plant nutrition.

Naghski (J.), McAuliffe (H. D.), Haley (D. E.), & Reid (J. J.). **The relation of delayed ammonification and nitrification to leaf spot diseases.**—Abs. in *J. Bact.*, xxxvii, 2, p. 234, 1939.

The significant uptake of nitrogen associated with the susceptibility of tobacco to leaf spot disease [*Bacterium tabacum* and *Bact. angulatum*: see preceding and next abstracts] during the ripening period in Pennsylvania was shown to be correlated with excessive amounts of nitrates in the soil, caused in some instances by delayed ammonification and nitrification of the organic nitrogen applied in the spring, and in others by the retarded nitrification of ammonium salts, which have probably remained for lengthy periods in a relatively insoluble form, e.g., ammonium magnesium phosphate. An insufficient spring rainfall usually induces delayed ammonification and nitrification, while the subsequent occurrence of heavy precipitation as the crop approaches maturity leads to an intensification of these processes and consequent loss of resistance to disease in the crop. It is concluded from these observations that the incorporation of large amounts of complex organic nitrogen in a soil to be used for tobacco is unsafe. Hence tobacco should not follow a leguminous crop, nor should fresh animal manure be applied to the soil.

Reid (J. J.), Naghski (J.), Harris (R. G.), & McAuliffe (H. D.). **A cultural and serological study of Phytomonas tabaca and certain related forms.**—Abs. in *J. Bact.*, xxxvii, 2, pp. 234–235, 1939.

A comparative physiological and serological investigation at the Pennsylvania Agricultural Experiment Station of strains of *Phytomonas tabaca* [*Bact. tabacum*], other *P.* spp. [including *Bact. angulatum*] associated with tobacco leaf spots [see preceding abstracts], known strains of *Pseudomonas fluorescens*, and over 2,000 isolations of

the last named from normal tobacco and clover, showed that *P. fluorescens* becomes indistinguishable from *Bact. tabacum* in these respects when cultured in untreated plant extracts with a high nitrogen content. The similarity thus induced may be lost as rapidly as it is acquired by frequent passage through other artificial media. It is concluded from these results that *Bact. tabacum* represents a purely transient physiological adaptation of *P. fluorescens*, and the same probably applies to the other leaf-spotting *Bact.* spp., though the evidence from tests with the latter was not quite as definite as that from the wildfire trials.

Thung (T. H.). **Phytopathologische waarnemingen.** [Phytopathological observations.]—*ex* Jaarverslag 1937–1938 [Annual Report for 1937–8].—*Meded. Proefst. vorstenl. Tab.*, 87, pp. 23–46, 2 pl., 1939.

During the period under review the average incidence of mosaic in the Vorstenland tobacco plantations [*R.A.M.*, xviii, p. 207] amounted to 1 per cent. at the onset of active growth about a week after the first irrigation and spread rapidly. Of the various chemicals tested for the disinfection of the coolies' hands between one cultural operation and another, 4 per cent. commercial formalin for five minutes was the only one suitable for practical use [ibid., xvii, p. 489]. At the Deli (Sumatra) Experiment Station the American recommendation of trisodium phosphate [ibid., xvi, p. 658] is preferred to formalin, and the writer's experiments with this preparation at concentrations exceeding 8 per cent. also gave satisfactory results. The immunization of tobacco plants against severe mosaic by inoculation with the mild strain of the disease, thereby preventing heavy losses, was experimentally shown to be feasible.

Other virus diseases of tobacco causing severe damage during 1937–8 were perforation or pox, a disorder associated with foliar crinkling and prominent white spotting (D), probably transmitted by *Bemisia*, a mosaic producing long, filiform leaves (M), and a sap-transmissible disturbance characterized by drooping of the middle leaves, accompanied by brown depressions along the veins and mottling of the upper foliage. Of these, the first-named has been found to originate in lombok [*Capsicum minimum*] plantings, whence it is conveyed to tobacco by *Myzus persicae*; on *C. minimum* the symptoms are frequently masked.

Groundnuts appear to promote heavier attacks of slime disease (*B[acterium] solanacearum*) in the succeeding tobacco crop [ibid., xviii, p. 279] than rice. Successful control of this disease, the incidence of which is undoubtedly on the increase in the Vorstenland, has been achieved by soil disinfection with cryptonol [ibid., xvii, p. 182] or terbolan [ibid., xvi, p. 780], supplemented by hoeing and drying-out of the beds. It was ascertained by two methods (planting in a diseased field plot and in inoculated soil in trays) that the hybrids R749×R518, R518×R.v.Am., and R749×KW10, are considerably more resistant to *Bact. solanacearum* than the Kamari controls.

Of recent years there has been a marked local decline in the amount of infection by *Phytophthora* [*parasitica* var. *nicotianae*: ibid., xviii,

p. 419], the number of dead plants over an area of 540 bouws [1 bouw = 0·71 hect.] on 30th November, 1938, being 69,995 as compared with 229,991 on the corresponding date in 1934 (536 bouws); some of these losses, moreover, are attributable to *Bact. solanacearum*, the two diseases being indistinguishable in the later stages.

There was no appreciable extension of mildew [*Erysiphe cichoracearum*] during the period covered by the report. In a plot where the routine sulphur spraying was omitted the Timor-Vorstenland variety remained practically immune from infection, whereas the adjacent rows of Chl[orina]×KW10 were heavily attacked.

Brief notes are given on the tobacco diseases due to *Bacillus* [*Erwinia*] *aroideae*, *Cercospora* [*nicotianae*], and *Alternaria longipes* [ibid., xvii, p. 490].

Szirmai (J.). **Untersuchungen und Beobachtungen an 'necrotic virus' im Zusammenhang mit dem Pilz Thielavia basicola Zopf.** [Studies and observations on 'necrotic virus' in connexion with the fungus *Thielavia basicola* Zopf.]—*Phytopath. Z.*, xii, 2, pp. 219–227, 7 figs., 1939.

Greenhouse-grown tobacco seedlings [(?) in Hungary] were found exhibiting a necrotic flecking of the leaves which was identified as a symptom of K. M. Smith's tobacco necrosis [*R.A.M.*, xvi, p. 570]. Examination of the root system of inoculated plants revealed the association of *Thielavia* [*Thielaviopsis*] *basicola* with the virus disease. The fungus was grown in culture and inoculation experiments on tobacco leaves with suspensions of the fungus resulted in the development of angular, coalescent spots which, although quite distinct from those caused by the virus, continued to enlarge after cessation of the growth of the fungus. The author tentatively attributes this increase in size of the spots to the secretion by the fungus of a virus-containing enzyme, and from additional experiments, which showed that lesions are only produced by living cultures of the fungus and that leaves inoculated with *T. basicola* alone contain no virus, concludes that a necrotic virus can only originate by an interaction, of a nature not yet fully understood, between the fungus and the root contents.

Godoy (E. F.). **El Oidium del Tomate. Su presencia en la Argentina.** [The *Oidium* of the Tomato. Its presence in the Argentine.]—*Rev. argent. Agron.*, vi, 1, pp. 49–52, 3 figs., 1939.

Forced tomato leaves and shoots in Jujuy, Argentine Republic, were attacked in July, 1938, by a species of *Oidium*, the initial white efflorescence being later replaced by chestnut-coloured, necrotic lesions involving the complete decay of the plants. The economic importance of the disease is considerable. The fungus has very short, septate conidiophores bearing at their apices chains of five to eight hyaline, ovoid or barrel-shaped conidia, 20·4 by 14·8 to 36·7 by 18·8 (average 25·8 by 15·9) μ, and possibly represents the imperfect stage (*O. erysiphoides*) of *Erysiphe polygoni* [cf. *R.A.M.*, vii, p. 674; x, p. 11]. Good control may be obtained by timely applications of ground sulphur.

KAUSCHE (G. A.). **Über die Darstellung von Kristallen und die Färbbarkeit des Aucubamosaik-Virus.** [On the preparation of crystals and the staining reaction of the aucuba mosaic virus.]—*Naturwissenschaften*, xxvii, 13, p. 212, 2 figs., 1939.

The author obtained hexagonal crystals resembling those found in the trichomes and epidermal cells of aucuba mosaic-diseased [tomato] plants [*R.A.M.*, xviii, p. 212] by placing in a moist chamber a slide bearing the centrifuged sediment of the virus precipitated with ammonium sulphate at P_H 5·5 and virus-containing expressed sap purified with animal charcoal. Data are also given, based on the staining of air-dry streaks of the virus crystals [ibid., xviii, p. 415] by simultan H and Victoria blue 4R Herzberg [ibid., xviii, p. 211], which are considered to establish a very close connexion between the tobacco [ibid., xviii, p. 481] mosaic and the tomato aucuba mosaic viruses.

BEST (R. J.). **The preservative effect of some reducing systems on the virus of Tomato spotted wilt.**—*Aust. J. exp. Biol. med. Sci.*, xvii, 1, pp. 1–17, 1 graph, 1939.

The effect of various reducing systems on the activity of suspensions of the virus of tomato spotted wilt from Blue Pryor tobacco plants was tested at the Waite Agricultural Research Institute, Adelaide [*R.A.M.*, xvii, p. 141].)

Hydrogen in the presence of platinized platinum arrested the normal aerobic inactivation of the virus in a buffer solution at P_H 7, and thereafter maintained the infective principle in an active state for the duration of the test (eight hours). Suspensions of the virus in the presence of cystein (0·01M) and absence of oxygen at P_H 7·5 were kept active for 35 days as compared with the normal *in vitro* period of a few hours. The sodium salts of glutathione, thioglycollic acid, and ascorbic acid (0·01M) protected the virus against rapid aerobic inactivation at P_H 7. Adrenalin at the same strength failed to prevent aerobic inactivation but was effective against the slow decline of virulence normally occurring in the absence of oxygen.

Discussing the redox potentials of the various reducing substances in relation to their relative efficiency as inactivation preventives, the writer points out the importance of allowing sufficient time for the attainment of an 'equilibrium'. The redox potentials at 'equilibrium' at 18° C. were (when oxygen was excluded throughout): glutathione —0·113, thioglycollic acid —0·102, ascorbic acid + 0·062, and adrenalin +0·107; the corresponding figures (after exposure to air) being + 0·006, —0·055, +0·096, and +0·123, respectively. These values are regarded as affording a convincing explanation of the action of the three first-named substances on the tomato spotted wilt virus; the adrenalin values are more difficult to interpret and must be considered in the light of the intensity and rate of reaction factors.

HUELSEN (W. A.). **Wilt-resistant Tomato varieties released by the Illinois Station.**—*Circ. Ill. agric. Exp. Sta.* 490, 22 pp., 9 figs., 1939.

In this circular, a revision of number 448, issued in 1936 [*R.A.M.*, xvi, p. 132], the Illinois Baltimore tomato is added to the list of field

varieties resistant to wilt (*Fusarium* [*bulbigenum* var.] *lycopersici*) [ibid., xviii, p. 422].

McCormick (Florence A.). **'Cephalosporium die-back' of Elms.**—*Phytopathology*, xxix, 4, pp. 371–372, 1939.

Dothiorella ulmi, the agent of *Cephalosporium* die-back of elms [*R.A.M.*, xviii, p. 281], the most prevalent disease of the tree in Connecticut, is ordinarily very virulent, but two elms have survived an eleven-year period of infection without apparent deterioration in health—in fact, rather the reverse. Inoculation experiments with cultures from the diseased tissues have resulted only in mild infection, an indication of the exceptionally weak parasitism of the strain of *D. ulmi* concerned.

Fransen (J. J.). **Iepenziekte, Iepenspintkevers en beider bestrijding.** [The Elm disease, Elm bark beetles, and their joint control.]—Thesis, Wageningen Agricultural College, 118 pp., 3 graphs, 1939.

This is a comprehensive, fully tabulated summary of the results (already published in part from other sources) of investigations which have been in progress in Holland and elsewhere since 1930 in the joint control of the elm disease (*Ceratostomella ulmi*) and its insect vectors, *Scolytus scolytus* and *S. multistriatus* [*R.A.M.*, xvii, p. 142]. In connexion with the biological control of the beetles, mention is made of the parts played in their extermination by *Beauveria bassiana* [ibid., xiii, p. 549 and above, p. 521], numerous insects, nematodes, mites, and certain birds, such as tits, nuthatches, robins, and woodpeckers. A five-page bibliography is appended.

Went (Johanna C.). **Verslag van de onderzoekingen over de Iepenziekte verricht op het Phytopathologisch Laboratorium 'Willie Commelin Scholten' te Baarn, gedurende 1938.** [Report on the Elm disease investigations conducted at the 'Willie Commelin Scholten' Phytopathological Laboratory, Baarn, during 1938.]—*Tijdschr. PlZiekt.*, xlv, 2, pp. 52–62, 1939.

This is a further progress report on the work of testing elm seedlings for their reaction to *Ceratostomella ulmi* [*R.A.M.*, xvii, p. 780 and next abstracts], the inoculations being performed both by needle pricks and with the aid of infected [*Scolytus*] bark beetles. Of a total of 308 open-pollinated seedlings of *Ulmus foliacea*, *U. glabra*, and *U. pumila* (including a number of the two first-named from Rumania), 130 contracted the disease (six in a mild form). The survival of a large percentage of French and Spanish material of *U. foliacea* in a Utrecht nursery is attributed rather to their slow growth in the local heavy clay soil (unsuitable for the purpose in view) than to any strong inherent resistance to the fungus. The percentage of two-year-old seedlings of different varieties of *U. hollandica*, *U. glabra*, *U. foliacea*, *U. turkestanica*, and *U. laevis* (female parent only known) contracting infection was 54, the corresponding figure for three-year-old specimens of the same, excluding the two last-named and with the addition of *U. procera vanhouttei*, being 74. In experiments on selected lines, Nos. 42 and 43 of *U. foliacea*, of Spanish origin, proved highly resistant

(though in inoculations with beetles the former was less reliable), while the Christine Buisman variety also continued to give satisfactory results.

C. ulmi was not destroyed by the application of copper sulphate to the bark as recommended in the United States [ibid., xvii, p. 568].

KRIJTHE (N.). **Verslag over de werkzaamheden voor het Iepenziekte-Comité verricht aan het Laboratorium voor Erfelijkheidsleer in 1938.** [Report on the operations conducted on behalf of the Elm Disease Committee at the Laboratory of Genetics in 1938.]—*Tijdschr. PlZiekt.*, xlv, 2, pp. 63–70, 1939.

Details are given of the methods of hybridization practised in the development of elm selections for use in Holland by the Elm Disease Committee [in connexion with their trials for varietal reaction to *Ceratostomella ulmi*: see preceding and next abstracts], and of the cytological characters (chromosome numbers) of a number of *Ulmus* spp. undergoing trials, supplemented by tables showing the pollination, sowing, germination, and production figures of a number of in- and outdoor crosses.

KRIJTHE (N.) & WENT (J[OHANNA] C.). **Inoculaties van Iepenbastarden verricht in 1938.** [Inoculations on Elm hybrids performed in 1938.] —*Tijdschr. PlZiekt.*, xlv, 2, pp. 71–74, 1939.

The results of inoculation experiments in 1938 with the causal organism of the Dutch elm disease [*Ceratostomella ulmi*] on 88 two-year-old hybrids (464 plants) [see preceding abstracts] denoted a clear correlation between growth habit and reaction to the fungus, the percentages of infection for *Ulmus glabra*, *U. foliacea* (large broad-leaved), *U. foliacea*, and *U. foliacea* (small-leaved) being 76·6, 53·7, 63·2, and 42·8, respectively, with a total for the entire number of crosses (including *U. pumila* and others) of 61·8. Besides *U. glabra* and the large-leaved types of *U. foliacea*, the progeny of crosses in which *U. laevis* was used as the female parent were also very susceptible, 14 out of 15 plants contracting infection.

GRANT (T. J.) & SPAULDING (P.). **Avenues of entrance for canker-forming Nectrias of New England hardwoods.**—*Phytopathology*, xxix, 4, pp. 351–358, 1 fig., 1939.

In the course of a study of naturally formed *Nectria* [including *N. coccinea*] cankers on birches, maple, aspen [*Populus tremula*], hickory, and pin cherry [*Prunus pennsylvanica*] in New Hampshire, Vermont, and Connecticut forests [*R.A.M.*, xviii, p. 280], 29 per cent. of the 3,161 examined arose from dead branch stubs measuring from $\frac{1}{8}$ to 1 in. in diameter, 27 per cent. from unmeasured dead branch remnants, 15 per cent. were formed in living branch axils, 8 per cent. were associated with rubbing injuries, and in 21 per cent. the channel of entrance could not be determined. The diameters of 92 per cent. of the 925 dead branch stubs ranged from $\frac{1}{8}$ to $\frac{1}{2}$ in., and those of 95 per cent. of the 470 living branches with axillary cankers from $\frac{1}{2}$ to 3 in.; 25 per cent. of all the measured dead branch stub cankers and 24 per cent. of all the axillary ones fell in the $\frac{1}{2}$ in. diameter classes. Observations

showed that small young branches, buds, and short spurs often serve as avenues of infection, but branches over ½ in. in diameter do not allow entry into the larger branches unless infection occurs at or very close to their axes.

The results of inoculation experiments performed in September, 1935, on red maple [*Acer rubrum*] and yellow birch [*Betula lutea*], in conjunction with field observations, point strongly to the habitual occurrence of infection through living or dying branches rather than through completely dead stubs. Small stems are generally more readily girdled than large ones, while autumn and winter injuries are liable to cause heavier damage than those inflicted in the late spring and early summer, when prompt activity of the cork cambium may serve to arrest the initial spread of the causal organism.

Jørstad (I.) & Juul (J. G.). **Råtesopper på levende nåletraer.** [Rot fungi on living conifers.]—*Medd. Skogforsøksv.* 22 (vi, 3), pp. 300–496, 30 figs., 8 diags., 1938. [English summary.]

This is a comprehensive monographic survey, followed by a 14-page bibliography, of the incidence, host range, taxonomy, economic importance, symptomatology, modes of infection, and control of the following fungi causing decay of living spruce (*Picea abies*) and Scots pine (*Pinus sylvestris*) in Norway, the descriptions of the sporophores and various types of rot being based on a study of indigenous material: *Coniophora* allied to *C. olivacea* (spruce and pine), *Polyporus schweinitzii* (larch, pine, occasionally spruce, oak, and *Prunus avium*), *Polyporus* [*Fomes*] *pinicola* [*R.A.M.*, xviii, p. 361] (spruce and pine), *P. borealis* [loc. cit.] (spruce only), *P.* [*F.*] *pini* [loc. cit.] (pine and spruce, rarely European larch), *P. tomentosus* Fr. var. *circinatus* (Quél.) n. comb. (Syn. *Pelloporus tomentosus* var. *circinatus* Quél.) causing a basal white rot of spruce, and *Stereum sanguinolentum* (brown heart rot of spruce).

Škorić (V.). **Žilavka tigrasta—Lentinus tigrinus (Bull.) Fr. Studije o biologiji, razvoju i patološkom djelovanju gljive.** [Tiger 'žilavka'—*Lentinus tigrinus* (Bull.) Fr. Studies on the biology, development, and pathogenic properties of the fungus.]—*Ann. Exp. for., Zagreb, 1938*, 6, pp. 98–126, 5 pl., 6, figs., 4 graphs, 1938. [Received June, 1939.]

Lentinus tigrinus [*R.A.M.*, xvi, p. 4] is stated to occur commonly in Yugoslavia on stumps of oak, alder, maple, apple, and willow [*Salix*] trees as well as on living apple and willow, and also on oak railway sleepers. In culture, spores of the fungus began to germinate after 8 hours at 26° to 36° C., the optimum temperature being 32°, and after six days at 4°, but no germination took place at 42·5°. Spores taken from sporophores showed 100 per cent. germination at nine months and 4 per cent. when four years old. The fungus grew poorly at P_H 2·75, best at P_H 3·4 to 3·7, and not at all at P_H 7·05. The minimum, optimum, and maximum temperatures for mycelial growth were below 4°, 32°, and 40° to 42·5°, respectively. The mycelium was killed in 45 minutes at 65°. It is composed of two types of hyphae, one thin-walled, about 3 to 4 μ thick, with numerous clamp-connexions, forming lemon- or pear-shaped, colourless chlamydospores, 9 to 13 by 7 to 9 μ, and

provided with some characteristic coiled parts. The second type, which develops at a late stage of growth, is profusely branched, thick-walled, 1·3 to 1·8 μ in diameter, and bears no chlamydospores or clamp-connexions. The fungus is homothallic. Successful inoculation of apple trees was only possible through wounds, and in nature the fungus was observed to enter the trees through wounds caused by insects.

ŠKORIĆ (V.). **Jasenov rak i njegov uzročnik.** [The Ash canker disease and its causal organism.]—*Ann. Exp. for., Zagreb, 1938*, 6, pp. 66–97, 6 pls., 5 figs., 1938. [Received June, 1939.]

The bacterial canker of ash is stated to occur in Yugoslavia most commonly along the river Sava and its tributaries. In some cases whole stands are uniformly infected, but more frequently diseased trees are found in groups. Young infected trees become dwarfed and do not attain a height of more than 1 to 2 m. The cankers are mostly of the depressed type, the verrucose form described by Van Vliet [*R.A.M.*, xi, p. 12] being less common. In the early stages they are mostly found near or round the leaf scars, but both primary and secondary cankers occur also in the internodes. Small cankers of the depressed type are formed in one to two years, but large ones (10 to 20 cm. in diameter) take 10 to 30 years to develop. Isolations of the causal organism were inoculated by needle pricks into the bark of *Fraxinus excelsior*, *F. americana alba*, olive, and oleander, but infection resulted in the first-named only. Spraying unwounded ash trees with bacterial suspensions gave no infection.

A comparative study of the ash, olive, and oleander organisms revealed many similarities in their morphological and cultural characters and biochemical activities, but the ability of each to infect only its own host and the differences in the type of reaction produced on the respective hosts is considered to justify the conclusion that the ash organism is a distinct species, identical with *Bacterium savastanoi* var. *fraxini* [ibid., xvi, p. 216] (except that the thermal death point is 48° C. instead of 43° to 46°), and it is accordingly raised to specific rank as *Pseudomonas* (*Bact.* or *Phytomonas*) *fraxini* (Brown) Škor. n. comb. The bacteria were observed to be intercellular (intracellular in damaged cells only). Rain is believed to be the main agent in the spread of the disease, neither wind nor insects playing a significant part. Infected trees should be early removed from ash stands in order to prevent further spread of the disease.

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xiii, 4, pp. 84 M, 86 M, 1939.

DOMINICAN REPUBLIC. Decree No. 74 of 7th November, 1938, prohibits the importation into the Dominican Republic of living or dead material of *Musa* spp. from Central America, Queensland, Java, Malaya, and Fiji in order to prevent the introduction of *Cercospora musae* [*R.A.M.*, xviii, p. 329], and from Haiti [ibid., xviii, p. 327] with a view to the exclusion of an undetermined banana disease.

KENYA. The Schedule to Government Notice No. 688 of 2nd September, 1937 [ibid., xvii, p. 640] is amended by the addition of barberry and buckthorn (*Rhamnus cathartica*).

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Biraghi (A.). **Alcune gravi lesioni prodotte da gas tossici su rami di Nocciolo.** [Serious lesions produced by toxic gases on Walnut branches.]—*Boll. Staz. Pat. veg. Roma*, N.S., xviii, 4, pp. 497–508, 1 pl., 5 figs., 1938 (issued April, 1939).

A detailed description is given of injuries observed on the branches of walnut trees growing in the vicinity of a chemical works [cf. *R.A.M.*, xviii, p. 466] engaged in the manufacture of nitrobenzene. These injuries, which, in the absence of any other ascertainable cause, are attributed to repeated exposure to fumes containing sulphur dioxide and nitrous gases, occurred chiefly as extensive areas in which the periderm had become detached from and raised above the underlying tissue and had produced scaling. In other cases, especially in the branches of the current year, the lesions resembled cankers, the bared tissue being black, or in worse cases, violaceous-red and cracked. The gases appeared to have inhibited the suberization of part of the protective barriers formed between the outer necrosed tissues and the living part beneath.

Wilde (S. A.) & White (D. P.). **Damping-off as a factor in the natural distribution of Pine species.**—*Phytopathology*, xxix, 4, pp. 367–369, 1 fig., 1939.

Experimental evidence is briefly adduced as indicating a correlation between soil constitution and the incidence of damping-off [*Pythium de Baryanum*, *Corticium solani* and other fungi: *R.A.M.*, xviii, p. 358] of red, white, and Austrian pines (*Pinus resinosa*, *P. strobus*, and *P. nigra* [var. *austriaca*]) in the Wisconsin Arboretum, near Madison. On eroded patches of sandy soil none of the species sustained losses exceeding 8 per cent., whereas on heavy mull the susceptible *P. resinosa* suffered 96 per cent. destruction, *P. strobus* being much less affected and *P. nigra* var. *austriaca* remaining immune. It is open to question, in the light of these results, whether further extensive plantings of susceptible northern conifers should be laid down on heavy soils of calcareous origin.

Garren (K. H.). **Studies on Polyporus abietinus. III. The influence of certain factors on the rate of decay of Loblolly Pine sapwood.**—*J. For.*, xxxvii, 4, pp. 319–323, 1 graph, 1939.

Statistical analyses of the results of decay in loblolly pine (*Pinus*

taeda) sapwood by *Polystictus abietinus* at Duke University [North Carolina: *R.A.M.*, xviii, p. 284] revealed a definite correlation between the rate of rotting and (a) the specific gravity and (b) the moisture content of the wood. The latter factor has been generally accepted as a predisposing influence, but the connexion between specific gravity and decay is a highly controversial question. The writer's data showed that resistance to *P. abietinus* increases with a rising specific gravity, the average loss in dry weight over a four-month period among blocks of uniform moisture content being 0·3504 per cent. less for each additional unit of specific gravity. Similarly, the average loss in dry weight among blocks of uniform specific gravity is 0·1072 per cent. less for each additional unit of moisture. The regression coefficients for a seven-month period are likewise negative, whereas after ten months they are positive, due probably to the progress of the decay to a point at which all the spring wood has been destroyed and the fungus is beginning to attack the summer wood: at this stage an increase in specific gravity would obviously provide more material for infection.

Spread of White Pine blister rust in 1938.—*Plant Dis. Reptr*, xxiii, 4, pp. 58–63, 1 map, 1939. [Mimeographed.]

During 1938 blister rust [*Cronartium ribicola*: *R.A.M.*, xviii, p. 359] was found for the first time on either white pine [*Pinus strobus* and *P. monticola*] or *Ribes* spp. in six counties in the southern Appalachian States, 60 in the north-central, and two each in Montana and California. The present distribution is clearly indicated on the accompanying map.

Škorić (V.). **Da li je Pholiota adiposa Fr. ili Pholiota aurivella (Batsch) Fr. uzročnik karakteristične truleži Jelova drva.** [Is *Pholiota adiposa* Fr. or *Pholiota aurivella* (Batsch) Fr. the causal agent of the characteristic rot of Fir wood?]—*Ann. Exp. for., Zagreb, 1938*, 6, pp. 61–65, 2 pl., 1938. [Received June, 1939.]

The rot of firs [*Abies*], usually attributed in Yugoslavia to *Pholiota adiposa* [*R.A.M.*, xvi, p. 716] has been found by comparative studies of isolations from rotted wood and from spores to be really due to *P. aurivella* [ibid., xiii, p. 532]. The rot is fairly widespread throughout the country, and the fungus also occurs on beech and ash.

Wolf (C. B.). **Other species of Cypresses as substitutes for the Monterey.**—*Calif. Citrogr.*, xxiv, 6, pp. 199, 222–225, 5 figs., 1939.

After referring to the present situation with regard to the disease of Monterey cypress (*Cupressus macrocarpa*) in California caused by *Coryneum cardinale* [*R.A.M.*, xviii, p. 492], the author gives a preliminary report on the results obtained in ten test plantings started in various localities in an attempt to find a suitable substitute for the doomed species. Of the eight other kinds of native cypress tested, Gowen's (*Cupressus goveniana*) and Mendocino (*C. pygmaea*) were found to be susceptible to the disease and should therefore not be planted; McNab (*C. macnabiana*), Piute (*C. nevadensis*), and Modoc (*C. bakeri*) are likely to prove resistant but are too slow growing for windbreaks, while Sargent's (*C. sargentii*), Dutton's (*C. sargentii duttonii*), and Tecate (*C.

forbesii) are probably immune from the disease and suitable for windbreaks and hedges, some of them growing more rapidly than the Monterey.

In an accompanying article by D. J. Thompson it is pointed out that eucalyptus is in many respects a satisfactory windbreak but that it has the disadvantage of being, in contrast to cypresses, a gross feeder, draining water and plant food from the adjacent citrus trees.

SCHULZE (B.), THEDEN (G.), & VAUPEL (O.). **Röntgen-Interferenz-Untersuchungen einheimischer Holzarten im gesunden Zustand und nach Pilzangriff.** [X-ray interference studies on indigenous timbers in a sound condition and after fungal infection.]—*Holz Roh- u. Werkstoff*, I, pp. 75–80, 1938. [*Abs. in Zbl. Bakt.*, Abt. 2, c, 4–8, p. 174, 1939.]

A study of the X-ray diagrams of cross, radial, and tangential sections of spruce and pine blocks artificially inoculated with *Coniophora cerebella* [*C. puteana*], *Poria vaporaria, Merulius lacrymans*, and *Trametes pini* revealed extensive dissolution of cellulose by the three first-named, involving the total disappearance of this substance by the end of six months in the case of *P. vaporaria* on spruce and coinciding with progressive weakening of the interferences. *T. pini*, on the other hand, caused no alteration in the diagrams during the experimental period. The 'cord' mycelium of *M. lacrymans* produced the interferences characteristic of animal and vegetable chitin.

HUNT (G. M.). **Wood preservatives and their application.**—*Pests*, vii, 2, pp. 9–13, 1939. [Abs. in *Chem. Abstr.*, xxxiii, 11, p. 4400, 1939.]

The requirements for a good timber preservative are defined, and testing and application methods described in detail. The principal substances now in use include coal tar creosote, carbolineums, zinc chloride, chromated zinc chloride, and sodium fluoride, the characteristics of each of which are discussed. Clean, non-swelling preservatives are prepared by the solution of various toxic chemicals, e.g. penta- and tetrachlorophenol, 2-chloro-*o*-phenylphenol, β-naphthol [*R.A.M.*, xv, p. 658], and α-nitronaphthalene, in a volatile petroleum base. The compositions of some proprietary compounds are given.

MEYER (W.). **Fluorhaltige Holzimprägnierungsmittel.** [Fluorine-containing timber preservatives.]—*Farbenztg*, xliii, 52, pp. 1374–1375, 1938.

This is a summary and discussion of the official German regulations governing commerce in fluorine-containing timber preservatives.

JOYCE (R.). **Economics of wood preservation in underground coal-mining.**—*Tech. Publ. Amer. Inst. Min. Engrs* 1067, 9 pp., 1939.

In 1928, 1929, and 1930, 223,258 mine ties impregnated by the full cell pressure process with a net retention of ½ lb. zinc chloride per cu. ft. were installed on main haulage in a group of bituminous coal mines. They cost $0·7133 each delivered at the mines, the corresponding

figure for untreated material being $0·4017. To date, two renewals have been spared by the treatment, representing cash savings of $366,835 for an added first charge of $69,602. Taking interest charges into consideration, the annual charges for untreated and treated ties are $0·2561 and $0·1323, respectively. In 1917 a few southern pine [*Pinus palustris*] ties impregnated by the Rueping pressure process with 8 lb. creosote per cu. ft. were laid down, the annual charge in this case being $0·14237 compared with $0·297 for untreated material. The estimated life durations of the zinc chloride- and creosote-treated ties are 12 (probably up to 16) and 20 years, respectively, compared with 3·7 and not over 4, respectively, for untreated. The replacement costs of oak bottoms of mine cars were $24·93 for creosoted and $19·56 for untreated, impregnation resulting, however, in a saving of $6·96 over 12 years. The annual charges per set of oak mine timbers installed in 1928 were $2·695 and $0·642 for untreated and creosoted, respectively.

WEGELIUS (T.). **Om röta i sulfitved och dess inverkan på fabrikations-processen och massautbytet.** [Sulphite wood decay and its influence on the manufacturing process and pulp yield.]—*Finsk PappTidskr.*, *1938*, 15 a, pp. 125–726, 128–130; 15, pp. 594, 595–598, 5 figs., 4 graphs, 1938.

The loss of coniferous wood on sorting the chips prior to processing in Finnish paper mills was found to be much higher in material damaged by fungal rots (*Polyporus* [*Fomes*] *annosus*, *Stereum sanguinolentum*, *Armillaria mellea*, *Ceratostomella piceae*, *C. coerulea*, and miscellaneous species of *Coniophora*, *Corticium*, *Lenzites*, &c.) than in sound wood, mainly owing to the profusion of fine particles in the softened chips. The pulp yield was consistently higher in sound wood, which also had a lower content of undefibred wood substance and was stronger and easier to bleach. The resistance of the sulphite cellulose to water, bases, and acids declined with an increase in chip decay. The degree of decomposition of the wood did not noticeably affect the cellulose, lignin, pentosan, resin, and fatty substance contents of the pulp, but the amount of ash rose with increasing deterioration. There was no appreciable reduction in the cellulose content even of badly decayed wood (94·4 as against 97·2 per cent. for healthy material), but the quality was impaired, more especially for rayon manufacture [*R.A.M.*, xvii, p. 239]. The α-, β-, and γ- cellulose contents of sound, somewhat decayed, and badly rotted wood were 87·5, 3·2, and 9·3; 75·8, 17·9, and 6·3; and 46·1, 48·6, and 5·3 per cent., respectively, from which it is apparent that fungal disintegration involves a fall in the α- and a corresponding rise in the β-cellulose contents of the wood.

WALKER (J. C.). **Diseases of vegetable crops.**—67 pp., 1939. [Mimeographed: obtainable from the author, College of Agric., Madison, Wisc., price $1·75.]

This is the first revised edition of the author's advanced course in vegetable pathology [*R.A.M.*, xv, p. 187], presenting in a succinct form the chief facts concerning the major diseases of 19 vegetable crops.

Nugent (T. J.) & Cook (H. T.). **The use of chloropicrin as a seed treatment for black rot of Kale.**—*Larvacide Log*, i, pp. 114–119, 1 graph, 1938. [Mimeographed. Received May, 1939.]

A detailed, tabulated account is given of trials at the Virginia Truck Experiment Station in the control of black rot of kale [*Pseudomonas campestris*] by seed treatment with chloropicrin [*R.A.M.*, xviii, p. 443]. The seed was inoculated with a suspension of the organism and exposed to the gas at various concentrations in sealed tubes or flasks (the latter giving more uniform results) for 24 hours. Used at a strength of 0·88 c.c. per l. space, chloropicrin increased the number of sterile seeds from 2·9 (untreated) to 79·3 per cent., simultaneously reducing the incidence of [unspecified] fungal and bacterial contamination from 77 to 4·6 and from 43 to 16 per cent., respectively. *P. campestris* did not develop in any of the potato dextrose agar plates to which the treated seed was transferred. Mercuric chloride (1 in 1,000, 20 minutes' immersion) and hot water (122° F., 30 minutes) were similarly completely effective against black rot. The germination percentages for the chloropicrin, mercuric chloride, and hot water treatments were 64, 72, and 61, respectively, compared with 75 for the controls. In tests to determine the influence of the moisture content of the seed and of temperature on the chloropicrin-treated material very little injury was observed at the different concentrations (up to 3·52 c.c. per l.) with a moisture content of 6·5 per cent. even at the high temperature of 40° C., whereas at 14·5 per cent. practically all the seed was killed under the same conditions.

Bennett (F. T.) & Edney (L. E.). **'Brown heart' of Swedes.**—*J. Minist. Agric.*, xlv, 12, pp. 1232–1239, 1 pl., 1939.

In field tests carried out in Cumberland in 1938 on the control of brown heart of swedes [*R.A.M.*, xviii, p. 364], the Tipperary, Edmonson's Jubilee, Monument, Garton's White-fleshed, and Great Scot varieties were grown in series of six $\frac{1}{5}$ acre plots, each of which received the usual manurial treatment and other dressings of equivalent amounts of nitrogen, phosphorus, and potash. In addition applications were made of basic slag, boronated basic slag ($12\frac{1}{2}$ cwt. per acre), borax (20 and 10 lb. per acre), and boronite (1 cwt. per acre, containing 17·85 per cent. borax); the average percentages of roots (all varieties together) badly affected by brown heart were, respectively, 59, 5, 4, 11, and 5, as compared with 51 per cent. in the controls. It is concluded that, in general, an application of 20 lb. borax per acre, or its equivalent in other materials, will give satisfactory control of brown heart of swedes under the conditions prevailing in Cumberland and Westmorland. Treatment with borax at £1 per cwt. costs under 4*s*. per acre apart from labour.

In general, purple-topped varieties suffer more severely than green-topped. In recent years the diminished use of manure and the greater chemical purity of artificial fertilizers have reduced the amount of boron in the soil, with a resultant increase in brown heart. Lime renders the boron compounds in the soil unavailable to plants, and where brown heart occurs, liming should be followed by a boron

corrective for the root crop, and if the application is heavy, the borax application should be correspondingly heavier, possibly up to 30 lb. per acre. Swedes may be severely affected by brown heart on acid soils, while beets and mangolds grown alongside show no symptoms of heart rot [ibid., xvii, p. 719].

WENZL (H.). **Schützt die Mosaikkrankheit der Rübe gegen Befall durch Cercospora beticola?** [Does the mosaic disease of the Beet confer protection against infection by *Cercospora beticola*?]—*Phytopath. Z.*, xii, 2, pp. 228–229, 1939.

The examination, in the autumn of 1938, of some 1,000 mosaic-diseased beets (mostly sugar) in 50 fields in the Upper and Lower Danube valleys, Austria, entirely failed to confirm Baudyš's observation in Czechoslovakia as to the immunity of such plants from infection by *Cercospora beticola* [*R.A.M.*, x, p. 78]. The attacks of leaf spot were equally heavy on mosaic and non-mosaic plants, involving both the old and heart foliage.

COONS (G. H.), STEWART (D.), & KOTILA (J. E.). **Sugar-Beet diseases. [ex Sugar-Beet culture in the humid area of the United States.]**—*Fmrs' Bull. U.S. Dep. Agric.* 1637, pp. 38–44, 2 figs., 1939.

The most important foliar disease of sugar beets in the humid area of the north-central United States is leaf spot (*Cercospora beticola*), which is thought probably to be present in every field each year, though a particular combination of climatic conditions is required to produce an epidemic. The fungus has been shown to persist on dried tops for at least three years. High temperatures are necessary for its rapid propagation, which is arrested by cool spring or summer weather. Rainy periods at intervals of a week or two and a warm spell in the first half of the growing period permit the organism to accomplish several successive cycles of increase and to spread throughout the field. Early attacks on the leaves result in reductions of both tonnage and sucrose, the latter also being sharply diminished by late infections. Early epidemics may reduce the root yields by two tons or more per acre and depress the sucrose percentage by upwards of two units, while for the average crop the combination of lowered root production and poor quality may cause a minimum loss of 25 per cent.

In areas where leaf spot is habitually prevalent, the regular application of Bordeaux mixture or copper dusts is justified and likely to produce definite gains, but where the disease is only of sporadic occurrence—as in Michigan, for example, where epidemics were reported in 1914, 1915, 1921, 1924, 1935, and 1937, with only localized damage in other years—direct control measures are uneconomical. A triennial crop rotation system should be adopted. The resistant variety U.S. 217 produced a highly satisfactory crop in the 1937 epidemic in Michigan.

Crop rotation is also an important factor in the control of the seedling diseases collectively known as damping-off or black root [*R.A.M.*, xviii, p. 441] and due to *Phoma betae*, *Pythium* spp. [including *P. de Baryanum*], *Rhizoctonia* spp. [including *Corticium solani*], and *Aphanomyces* spp. In general, sugar beet stands following maize are superior to those succeeding lucerne, sweet clover [*Melilotus alba*], and red

or crimson clovers [*Trifolium pratense* and *T. incarnatum*]. Adequate drainage, liberal applications of a phosphate fertilizer, prompt and thorough stirring and loosening to aerate and dry the soil, and selective thinning are also effective in the control of damping-off. The results of seed treatment with copper- or mercury-containing dusts are somewhat conflicting, no advantage accruing from the practice on certain soils, such as the Brookston clay of Ohio and heavy Michigan soils, whereas in those of a lighter type beneficial effects have been obtained. In order to secure good coverage the dusts should be used at the rate of 3 to 4 oz. per 15 lb. seed.

A note is given on the *Rhizoctonia* [*C. solani*] crown rot of mature beets [ibid., xviii, p. 494].

CORDON (T. C.) & HAENSELER (C. M.). **A bacterium antagonistic to Rhizoctonia solani.**—*Soil Sci.*, xlvii, 3, pp. 207–214, 1 pl., 1939.

A rough strain of *Bacillus simplex* was found to produce a diffusible, thermostable substance in both solid and liquid potato dextrose media which inhibited the growth or even caused the death of *Rhizoctonia* [*Corticium*] *solani*, isolated from diseased beans [*Phaseolus vulgaris*] at the New Jersey Agricultural Experiment Station. The bacterium developed in a nutrient agar culture on which tomato seeds had been plated and was probably carried on them as a contaminant. A nutrient medium in which *B. simplex* had grown contained such a high concentration of the toxic principle that it completely suppressed the development of the fungus after dilution to 5 per cent. of its original volume. The bacterium was also able to elaborate the toxic principle from Czapek's medium. The toxin is adsorbed by activated charcoal, from which it may be partially withdrawn by hot alcohol. It was not injured by the removal, by precipitation with alcohol or ammonium sulphate, of the bulk of the protein fraction from a nutrient medium made toxic to *C. solani* by the bacterium.

Treatment of a greenhouse soil infested by the fungus with a potato dextrose-peptone solution used for the culture of *B. simplex*, or with the living washed bacterial cells without nutrient medium, gave fair control of damping-off in cucumbers [ibid., xvi, p. 510] and peas [ibid., xvi, pp. 439, 611, *et passim*], which was also reduced to some extent by the fresh unused potato dextrose medium, possibly through encouragement of the saprophytic soil microflora. The following percentages of normal cucumber and pea seedlings were counted a fortnight after the various treatments: controls (tap water) 35 and 52 per cent., respectively, unused potato dextrose-peptone solution 65 and 55, the same at quarter strength 61 and 77, washed bacterial cells 58 and 75, autoclaved bacterial culture 55 and 80, the same at quarter strength 87 and 90, and the same, used continuously instead of tap water to maintain the moisture content during germination, 81 and 90.

EL-HELALY (A. F.). **Preliminary studies on the control of Bean rust.**—*Bull. Minist. Agric. Egypt* 201, 19 pp., 6 pl., 1939.

Bean (*Vicia faba*) rust (*Uromyces fabae*) is stated to be widely prevalent and to cause serious loss in Lower and Middle Egypt [*R.A.M.*,

xii, p. 749; xvii, p. 154]. In these localities incidence increases with the number of waterings given during the growing period. In one experiment, one watering (at sowing), two (sowing and flowering), two (sowing and pod formation), and three (sowing, flowering, and pod formation) gave, respectively, slight, severe, very severe, and very severe infection with average yields of 4·5, 4·8, 4·3, and 4·7, ardebs [1 ardeb = 1·98 hectol.] per feddan [0·42 hect.]. In Upper Egypt, where the disease is uncommon, soil moisture seems to have no effect on prevalence, high temperature being probably a limiting factor. Under Egyptian conditions, high atmospheric humidity associated with a strong north-westerly wind is conducive to severe outbreaks. Late sowings are usually more heavily infected than early ones.

Manurial applications and seed treatments with numerous materials had no effect on the disease. Very good control resulted, however, from four applications at fortnightly intervals of lime-sulphur (5 per cent. with 0·2 per cent. soap), sulsol (0·3 per cent. with 0·2 per cent. soap), bouisol (0·2 per cent.), and Bordeaux mixture (1 per cent.), which gave, respectively, 25, 35, 25, and 15 per cent. infection and average yields of 8·7, 7·6, 7·8, and 9·4 ardebs per feddan, as against 100 per cent. infection and a yield of only 5·1 ardebs per feddan in the untreated controls. Two applications of the same materials at weaker concentrations made at an interval of four weeks also gave very satisfactory results. The Bordeaux mixture and bouisol treatments in some cases gave an increase in net profit over the controls of 25 per cent. By delaying maturity, the copper sprays allowed the crop to ripen gradually and form large, unshrivelled seeds.

Yu (T. F.). **On the occurrence of Colletotrichum lindemuthianum (Sacc. & Magn.) on Broad Bean seeds.**—*Bull. Chin. bot. Soc.*, iii, 1, pp. 1–24, 2 pl., 3 graphs, 1937. [Received June, 1939.]

Colletotrichum lindemuthianum was isolated on potato dextrose agar and other media at 28° C. from broad bean seeds at Nanking University, this being apparently the first authentic record of the fungus on the host in question. The leaves of diseased plants bore circular, irregular, or angular, dark reddish-brown spots, 1 to 3 mm. in diameter, sometimes coalescing to form areas up to or exceeding 10 mm., the central portion turning cinnamon-buff to ashen-grey; similar but elongated or fusiform lesions, up to 1 cm. in length, are formed on the stems, while typical anthracnose spots with grey centres and red margins are also produced on the pods. Inoculation experiments on broad beans with spore suspensions under humid conditions resulted in the development of the characteristic symptoms after an incubation period of two to seven days, but all attempts to secure infection through the seeds were unsuccessful. None of the other Leguminosae inoculated with the broad bean strain of *C. lindemuthianum* proved susceptible. A full account is given of a comparative study on the broad and common bean (*Phaseolus vulgaris*) strains of the fungus, the pathogenicity of the latter being confined to different varieties of *P. vulgaris*. There were no conspicuous divergences between the two strains in respect of morphological and physiological characters.

WENCK (F.). **Lohnt sich die Bekämpfung der Blattfleckenkrankheit bei Sellerie?** [Does the control of Celery leaf spot pay?]—*Obst- u. Gemüseb.*, lxxxv, 3, p. 30, 1939.

In an experiment to determine the profitability or otherwise of fungicidal treatment for the control of celery leaf spot (*Septoria apii*) in the Ulm district of Germany [*R.A.M.*, xvii, p. 289], the yield of the area sprayed four times with 1 per cent. Bordeaux mixture amounted to 297·5 kg. per are, corresponding to an average rootstock weight of 633 gm. for the 470 plants comprising the stand. The untreated area yielded only 159·8 kg. per hect. (340 gm. each rootstock). The value of the 86 per cent. increased output of the sprayed area is estimated at RM. 550·80 per 0·25 hect., against which the costs of the treatment (RM. 34 per 0·25 hect.) are negligible.

STEVENSON (GRETA B.). **On the occurrence and spread of the ring spot disease of Lettuce caused by Marssonina panattoniana (Berl.) Magn.**—*J. Pomol.*, xvii, 1, pp. 27–50, 2 graphs, 1939.

Investigations [which are fully described] into lettuce ring spot (*Marssonina panattoniana* [*R.A.M.*, xiii, p. 668] showed it to be an important disease of winter lettuce in England, frequently causing marked reduction in the quantity and quality of the crop. It is seldom, if ever, found on lettuces headed out under glass, and is of minor importance on those grown in frames during winter and planted out in spring. Experimental evidence obtained during the years 1935 to 1938 demonstrated that the condition is seed-transmitted, the freedom or otherwise of the seed mother plants being strongly reflected in the ensuing crop; affected plants yield seed of high germinating ability and without surface blemish, but under suitable conditions, which frequently obtain in autumn, such seed produces a severely infected crop. On the other hand, seed from sprayed and segregated mother plants has given a crop almost free from infection whilst crops from commercial seed gave heavily diseased plants. Infection may also arise from the remains of an earlier, infected crop. The common weed *Crepis capillaris* may possibly be a source of infection. Sixteen commercial varieties tested were all highly susceptible. Under certain conditions the disease may remain latent for at least two months.

In a control experiment seed of the Commercial Market Favourite variety, untreated and treated with the supernatant liquid resulting from the mixture of bleaching powder with ten times its weight of water plus lethalate wetting compound (0·5 gm. per l.) was sown broadcast on a farm on 23rd October and one-third of the seedlings from each lot of seed was sprayed on 25th November and 31st December with Bordeaux mixture (3–6–50), another third with sulphur resin, and the remaining third left unsprayed. Of 204 seedlings transplanted from each treatment on 27th January, there survived on 3rd June 167 (92 diseased), 187 (27), and 192 (22) plants for the untreated seed unsprayed, sprayed with Bordeaux mixture, and sprayed with sulphur-resin, respectively, the corresponding figures for the seed treated with bleaching powder being 189 (34), 178 (12), and 173 (29). When similarly treated Imperial plants were left to overwinter in the

seed-beds and sprayed again on 14th March, the unsprayed plants from untreated seed were all badly diseased and brown, the Bordeaux-sprayed plants from the untreated seed mostly showed perforated leaves, but were green, while all the plants, sprayed and unsprayed, from the treated seed appeared clean.

It is recommended that lettuces grown in seed-beds until January or February should be sprayed with Bordeaux mixture (3–6–50), and that the seed used should be treated with bleaching powder solution, though further knowledge of the process is required to eliminate all risk of injury.

Snyder (W. C.) & Rudolph (B. A.). **Verticillium wilt of Pepper, Capsicum annuum.**—*Phytopathology*, xxix, 4, pp. 359–362, 1 fig., 1939.

The results of soil inoculation experiments in California, herein briefly described, confirmed previous observations as to the acute susceptibility of chilli (*Capsicum annuum*) to *Verticillium albo-atrum* [*R.A.M.*, xvii, p. 372], the Anaheim variety being more severely attacked than the Red. The fungus was isolated from the small lateral rootlets of Dwarf Champion tomatoes planted in pots formerly occupied by infected chillis, but the tap-roots and main stems were not involved, nor did any clear-cut aerial symptoms develop.

Waksman (S. A.) & Cordon (T. C.). **Thermophilic decomposition of plant residues in composts by pure and mixed cultures of micro-organisms.**—*Soil Sci.*, xlvii, 3, pp. 217–224, 1 pl., 1939.

A tabulated account is given of the activities of the thermophilic population of the straw and lucerne composts affording excellent growth of the edible mushroom (*Psalliota campestris*) at the New Jersey Agricultural Experiment Station [*R.A.M.*, xiii, p. 491] in the decomposition of plant materials, with special reference to *Thermomyces* at 50° C. [ibid., xviii, p. 342]. The presence of calcium carbonate was found to be essential for the rapid dissolution of plant residues as a whole, and of cellulose in particular, by the thermophilic fungi. *P. campestris* was found to derive its nutrients primarily from the lignin and its conversion products and from the proteins in the composts.

Williams (P. H.). **A Mushroom disease caused by Mycogone rosea.**—*Gdnrs' Chron.*, cv, 2729, p. 236, 1939.

Mushrooms [*Psalliota* spp.] recently received from Berkshire at the Cheshunt Research Station were found to be infected by *Mycogone rosea*, this being apparently the first authentic record of the fungus on the host in question. The surface of the caps was dark brown and the underlying tissue stained yellow. In some cases there were small depressions in the cap, below which the tissues were discoloured dark brown to a depth of about $\frac{1}{4}$ in.; in two instances alternate zones of brown and white marked the region of infection. *M. rosea* is readily distinguishable in culture from *M. perniciosa* [*R.A.M.*, xviii, p. 457] by its reddish- (instead of dark) brown coloration and its larger spores (upper and lower cells 35·5 and 20·8 μ in diameter in the former and 22·4 and 15·5 μ

in the latter). Positive results were obtained, after an incubation period of six to seven days, in inoculation experiments in which spores or mycelium of the fungus or small circles cut from a plate culture were placed on the surface of the cap.

ZYCHA (H.). **Mycologische Grundlagen der Champignon-Kultur.** [The mycological foundation of Mushroom cultivation.]—*Angew. Bot.*, xxi, 1, pp. 46–58, 5 figs., 1939.

In this general account of certain aspects of mushroom [*Psalliota* spp.] growing in Germany [cf. *R.A.M.*, xvii, p. 724], the following criteria are suggested for the differentiation of cultivated varieties: yield, the diameter of the cap, the height of the mushroom, the specific gravity of the unexpanded mushroom, the dry weight, the shrinkage and the firmness in preserving, the colour of the pileus, the sensitiveness to pressure as shown by discoloration, and susceptibility to certain insects. The nutritional requirements of the mycelium, the optimal conditions for the formation of fruit bodies (a regular and not too high rate of transpiration and constant conditions of humidity and temperature being of chief importance), and the diseases of the cultivated mushroom are also discussed.

JENKINS (W. A.). **The development of Mycosphaerella berkeleyii.**—*J. agric. Res.*, lviii, 8, pp. 617–620, 1 pl., 1939.

While the general plan of development of the spermogonia and perithecia of *Mycosphaerella berkeleyii* [the ascigerous stage of *Cercospora personata* on groundnut: *R.A.M.*, xvii, p. 651; xviii, p. 236] is stated to be almost identical with that of *M. arachidicola* [the ascigerous stage of *C. arachidicola*: loc. cit.], the former differed from the latter in the following details of structure and development: greater amounts of stroma surround the fruit bodies, the stromatic wall is thicker and the sterigmata longer, there are larger numbers of archicarps in the young perithecia and more fertile tissue in the base of the perithecium, periphyses are formed along the wall near the apex of the perithecium, and the ascospore discharge is somewhat protracted. In addition, the two fungi have already been found to produce different symptoms on their common host, and to differ in the type of conidial fructifications, host relationships, cultural characters, and ascospore dimensions.

BRANAS (J.), BERNON (G.), & LEVADOUX (L.). **Chronique. Sur les circonstances qui favorisent le développement du court-noué.** [Current notes. On the circumstances that favour the development of court-noué.]—*Progr. agric. vitic.*, cxi, 8, pp. 161–165, 1939.

The authors express the view that the fact that court-noué of the vine [*R.A.M.*, xviii, p. 294] is most prevalent in France in the most carefully tended vineyards is due to the deep digging over of the ground practised in such vineyards in winter. This digging amputates the roots to a depth of about 20 cm., and thus weakens the vines. Moreover, these superficial roots are infested with *Phylloxera vastatrix*, and as they wither after being cut off, the insects pass to the roots lower down, with the result that the more frequently the ground is dug over the more

often the vines become reinfected with the virus. In localities where the type of soil permits, deep digging should be abandoned.

Another practice that favours the development of court-noué is that of laying down a new vineyard immediately after an old infected one has been dug up, and on the same site, the new vines rapidly becoming infested by the insects from the old ones. Before replanting, sufficient time must be allowed to elapse for the old roots, and the insects on them, to die off.

The development of court-noué in a vineyard is closely related to the persistence of the amputated roots. The roots disappear most rapidly in loose, well-aerated soils free from excessive moisture, whereas in wet, compacted soils root debris persists for years. This explains why court-noué spreads chiefly in low-lying areas and damp plains.

DELLA BEFFA (G.). **Cronaca delle malattie e dei parassiti osservati nell' anno 1938.** [Report on diseases and parasites observed in the year 1938.]—*Boll. Lab. sper. R. Oss. Fitopat. Torino*, xv, 3–4, pp. 153–162, 1938. (Issued 1939.)

In this report on plant diseases noted during 1938 in the vicinity of Turin it is stated that numerous cases of pear rust (*Roestelia cancellata*) [*R.A.M.*, ix, p. 602] occurred. The apple crop in one orchard was destroyed completely by a form of rot associated with a *Fusarium* which began as a brown discoloration of the floral remnants, spread in a circular manner, and caused the collapse of a large part of the fruit tissues. Chestnuts were widely affected by black rot due to *Sclerotinia pseudotuberosa* and *Phoma endogena* [ibid., xv, p. 616]. In some localities over 50 per cent. loss was sustained. A *Botrytis* was isolated from a soft, black, malodorous rot of chestnuts. *Piper guineense* plants from Kenya were attacked by *Pseudomonas* [*Bacterium*] *tumefaciens*, not previously recorded on this host.

NEERGAARD (P.). **Aarsberetning fra J. E. Ohlsens Enkes Plantepatologiske Laboratorium 1 April 1938–31 Marts 1939**. [Annual report of the phytopathological laboratory of J. E. Ohlsen's widow from 1st April, 1938, to 31st March, 1939.]—16 pp., 1 pl., 1 fig., 2 graphs, 1939. [English and Esperanto summaries.]

In addition to an item already noticed from another source, this report [*R.A.M.*, xvii, p. 654] contains the following information. Among the 4,132 samples of horticultural seeds and bulbs inspected were observed, for the first time in Denmark, *Ascochyta cheiranthi* on wallflower, *Colletotrichum spinaciae* on spinach [ibid., xvi, p. 299], mosaic on Hollandia Wedgwood iris [ibid., xvi, pp. 254, 728], *Phyllosticta antirrhini* on *Antirrhinum majus* [ibid., xviii, p. 458], *Stagonospora curtisii* [ibid., xvii, p. 42] on *Hippeastrum vittatum*, and *Alternaria brassicae* (Berk.) Bolle: ibid., xviii, p. 493] on *Iberis umbellata*, apparently a new host for this fungus. A species of *Alternaria* occurring on five samples of *Gypsophila elegans* and shown by inoculation experiments on its host to be an agent of damping-off, was characterized by concatenate, clavate, dark brown conidia, 30 to 60 by 12 to 27 μ (average 44·2 by 18·1 μ) with 3 to 8 (5·8) longitudinal and 2 to 8 (5) transverse

septa, provided in some cases with beaks measuring 3 to 27 μ (9·5 μ) in length.

Taxonomic studies were conducted on six isolates of *Alternaria radicina* from carrot [ibid., xvii, p. 703], celery, and flax are labelled *A. malvae* from *Malva* [ibid., xvi, p. 773], and a contamination in a fungus culture *Stemphylium botryosum* [ibid., xviii, p. 141] var. *botrytis*). The average dimensions of the conidia on malt extract, oat, potato, carrot, and maize agar ranged from $31{\cdot}6\pm0{\cdot}38$ by $18{\cdot}5\pm0{\cdot}20\ \mu$ to $39{\cdot}9\pm0{\cdot}67$ by $16{\cdot}6\pm0{\cdot}19\ \mu$, and the average numbers of transverse and longitudinal septa from 2·9 to 4·4 and 2·5 to 3·3, respectively. It is concluded that all the isolates belong to different morphotypes of the same species, those from carrot I (isolated by Prof. J. Westerdijk in 1920) and *Malva* being of the same morphotype. The isolates under observation agreed well with the original diagnosis of *A. radicina*, whereas an examination of type material of *A. malvae* revealed marked differences between the conidia of the two species, those of the latter being paler and distinctly rostrate. *A. malvae* is accordingly retained as a good species and *A. radicina* transferred to *Stemphylium* (*Pseudostemphylium* sensu Wiltshire [ibid., xviii, p. 141]) as *S. radicinum* (M., D., & E.) nov. comb.

Progress Reports from Experiment Stations, season 1937–1938.—150 pp., 2 graphs, London, Empire Cotton Growing Corporation, 1939.

These reports [cf. *R.A.M.*, xvii, p. 455] contain, *inter alia*, the following items of interest. At Barberton, South Africa, *Alternaria* disease of cotton [loc. cit. and cf. ibid., xviii, p. 309] appeared towards the end of March, 1938; rapid spread was favoured by moist conditions in early April and by the reduced resistance of the plants, brought about by drought. The disease caused heavy loss of crop on parts of the loam soil where the plants were not well developed, but its effect was inappreciable on well-developed plants. On the granite soil the crop gave extremely good yields, none of the cotton suffering any ill effect from infection, probably because it benefited from the light showers that fell in the dry period between February and April. It is clear that resistance is closely associated with health, and all cotton lands are to receive regularly a compost dressing. A re-selection, 6128, made from 5143, has shown itself to be very resistant to drought and little affected by the disease.

Maize streak [loc. cit.] appeared late. Bulk plantings of the susceptible strains American White Flint and Anveld, sown on 29th and 30th November, showed virtually no infection throughout January, while plantings made on 4th January showed a mean infection of only 28·8 per cent. on 18th February. Out of 52 best selections of the variety Peruvian 39 lots had 100 per cent. uninfected plants.

In a seed disinfection test against cotton blackarm and bacterial boll rot [*Bacterium malvacearum*: ibid., xviii, p. 390] carried out in Swaziland, mechanically delinted seed from the previous season's crop was treated with proprietary mercurial dusts, a 'wet' mercury preparation (M12), sulphuric acid, and copper salts. The results showed that treatment with sulphuric acid, M12, and (to a less extent) the mercurial dusts conspicuously reduced primary infection. Sulphuric acid

increased the germination rate but not the total number of seedlings produced, the mercurial dusts made no significant difference in these respects, and both the copper salts and M12 retarded germination.

At Shambat, Anglo-Egyptian Sudan, the transference of blackarm resistance by repeated back-crossing was continued. Progenies of the composition X1530 × (X1530 × (X1530 × B. 31)) showed X1530 characters very strongly predominant, while plants showing resistance occurred within these progenies in numbers closely corresponding to the proportions expected. Similar results were given with back-crosses involving N.T. 2 strain, while more back-crossing on a large scale with both lines gave seed for sowing big progenies in the following season.

Evidence obtained in Uganda indicated that cotton wilt [*Verticillium dahliae* and *Fusarium* spp.: ibid., xvii, pp. 455, 504; xviii, p. 106] is more prevalent on fertile than infertile soils, increases in intensity near the bases of eroded slopes, and declines when cotton is grown year after year in the same plot. The Buganda Local strain shows more resistance than any Bukalasa Pedigree or introduced variety. The internal or chronic symptoms are probably present in over half the population of all Bukalasa Pedigree cottons and introduced varieties. The external or acute symptoms are more frequently present in the B.P. 50 family than in the B. 181 or the Nyasaland Upland families (S.G. 23/8 and B.P. 52). There is no evidence that more resistant populations are obtained by planting seed from plants that have remained healthy in diseased localities. Other work in Uganda showed that N. 17 and S.G. 29 are consistently more susceptible to blackarm than the S.P. varieties, that mass selection in N. 17 (N. 17/M. 1) did not give increased resistance, that S.P. 102 is the most resistant of all varieties tested, that S.P. 84 is more susceptible than S.P. 20 but more resistant than N. 17 and S.G. 29, and that B.P. 52 is more susceptible than N. 17.

The only important cotton disease observed during the season in Tanganyika was internal boll disease (*Nematospora* spp.) [*N. gossypii* and *N. coryli*: ibid., xv, p. 437; xviii, p. 308], which appeared in the Moshi area. In one locality, 40 acres were severely infected and produced only a negligible amount of lint. The only indigenous host of *N.* observed in the district concerned was an *Acacia*, a genus not before recorded as a host of *N.*

In further work in Tanganyika on cassava mosaic [ibid., xvi, p. 456; xviii, p. 373], in which two variety trials were harvested, one planted with diseased setts and the other with apparently clean material, the Mpera variety gave the best yield in both trials. Apparently there are a few tolerant varieties which give good yields under most conditions. A trial planted with setts, transplanted seedlings, and seed sown *in situ* showed conclusively that the best method of planting is by setts. Seed from clonal material of cassava varieties in the Tanganyika collection was sown between lines of diseased cassava, and over 1,000 single-plant progenies of seedlings that remained unaffected in 1937 were planted in progeny plots between other diseased rows in 1938. After three months only 5·8 per cent. of the plots were free from both mosaic and brown streak [loc. cit.]. Seven single-plant progenies unaffected in the second stage of the test in 1937 were planted in isolation, but all developed brown streak, though six remained free from mosaic.

HANSFORD (C. G.). **Report of the Senior Plant Pathologist.**—*Rep. Dep. Agric. Uganda, 1937–38* (Part II), pp. 20–25, 1939.

During the period under review preliminary cross-inoculation studies were carried out in Uganda with cultures of *Verticillium dahliae* [*R.A.M.*, xvii, p. 295] and numerous species of *Fusarium* associated with wilt diseases of cotton, simsim [*Sesamum orientale*], cassava, sann hemp [*Crotalaria juncea*], *Derris*, *C. striata*, *Capsicum annuum*, *Tephrosia vogelii*, and other plants. *V. dahliae* was isolated in the field from wilted plants of cotton, cassava, *S. orientale*, *Tephrosia*, and *Abroma*, while in inoculation tests in the laboratory it was pathogenic to young seedlings of these plants, as well as to *Capsicum* and *Crotalaria striata*. When seed of susceptible plants was sown in inoculated soil, infection by *V. dahliae* occurred in the absence of root injury, but a much larger proportion of infection resulted when the plants were grown for a few weeks in the pots before mixing the cultures with the soil, this operation damaging the finer roots. This supports earlier observations that infection by *V. dahliae* can often be traced to a damaged root. The wilt disease of *C. striata* due to a *Fusarium* of the *Elegans* group was found to be transferable to *C. juncea*, while the *Fusarium* isolated from *C. juncea* is also pathogenic to *C. striata*. Some individuals both of the original and alternate hosts appeared to show complete immunity. A much higher proportion of successful cross-inoculations was obtained in all cases when the plants were previously wounded.

Further foci of cotton wilt infection were discovered, the disease now having been recorded from nearly every important cotton-growing area in Uganda. As a rule, infection is confined to individual plants or small groups of plants, and is more serious only where the disease has been long established. On the whole, during 1937–8 it was of no economic importance.

Soil inoculations with mass cultures of *V. dahliae* resulted in a very low incidence of wilt, indicating that under field conditions this method is not a reliable test for resistance.

Isolations of *Bacterium malvacearum* [ibid., xvii, p. 392] from lesions on cotton plants at Kampala invariably gave cultures differing from the normal in the production of copious yellow slime on dextrose and saccharose media, and in forming no acid on dextrose media, while on nutrient agar they were a brighter yellow than normal strains isolated in previous seasons. The existence of variants in Uganda raises the question as to how far they differ in pathogenicity towards the cotton varieties developed locally for resistance to blackarm.

In December and January, cotton at Kampala was commonly affected by rust (*Kuehneola gossypii*) [*Cerotelium desmium*: ibid., xvii, p. 98], this being only the second record of the fungus in Uganda, but little damage was caused. The Uganda selections from U. 4.4.2 are more susceptible to *Cercosporella gossypii* [ibid., xvi, p. 838] than Nyasaland Upland or 'Buganda Local' selections. The only direct damage caused is due to boll infections, which are often invaded by bacteria.

During wet weather a number of selections of *Ricinus* [*communis*] were commonly affected by leaf spot due to *Bact. ricini* [cf. ibid., xiii, p. 565].

Tobacco mosaic was again a limiting factor in Ankale District, where, probably owing to climatic influences, it assumes a very serious form.

Sugar-cane mosaic is unimportant in Uganda [ibid., xvii, p. 296], as the varieties cultivated are very resistant or immune. Red stripe [*Bact. rubrilineans*: ibid., xv, p. 427] is, however, common on P.O.J. 2727, which is less resistant than P.O.J. 2725 and P.O.J. 2878. Several Coimbatore varieties are susceptible to *Cercospora sacchari* [ibid., xv, p. 607] as is also Uba, but no appreciable loss of crop is caused.

Cuttings of *Derris elliptica* at Kampala at first make fair growth, but later on the shoots die back almost to the base, and commonly show the presence of a *Diplodia* resembling the conidial stage of *Physalospora fusca* [ibid., ix, p. 344; xi, p. 697]; a *Fusarium* of the *Elegans* group has also been isolated.

Fifty-first Annual Report of the Kentucky Agricultural Experiment Station for the year 1938. Part I.—63 pp., [1939].

The following items occur in this report [cf. *R.A.M.*, xvii, p. 503]. After treatment with colchicin a few seeds were produced from the generally sterile F_1 hybrid of White Burley tobacco and *Nicotiana glutinosa* from which a fertile F_2 generation was grown. The fertile hybrid, which is to be used in breeding for mosaic resistance, contained two sets of chromosomes from tobacco (48) and two from *N. glutinosa* (24). The combination of the necrotic spotting factor from *N. glutinosa* and resistance from Ambalema was effected in several Burley strains. Twenty-one Burley selections containing the resistance factors from Ambalema were grown in the field and inoculated with a strain of white tobacco mosaic. Of 961 plants inoculated, 210 (or 21·8 per cent.) became invaded, ring patterns appearing as the leaves expanded. When cured the tobacco appeared to be of exactly the same quality as the standard Burley varieties. Similar results are being given by dark tobacco. It is considered that complete commercial control of tobacco mosaic may be obtainable by using resistant hybrids.

To secure mosaic-free tobacco for farm hands to chew while handling the crop a small block of Burley plants was inspected shortly before cutting and the mosaic plants were left unsuckered to be cut separately. One hundred and seventy twists of chewing tobacco made from the mosaic-free plants were found free from mosaic upon inoculation on *N. glutinosa*. This method could be used by growers to control mosaic.

Tobacco beds treated twice with Bordeaux mixture (3–3–50) showed no wildfire [*Bacterium tabacum*: ibid., xvii, p. 379; xviii, pp. 442 and 553] or angular leaf spot [*Bact. angulatum*: ibid., xvii, p. 776] at setting time, though about 75 per cent. of the untreated beds in the vicinity became attacked with one or other or both of these diseases.

In fields from treated beds, severe blackfire (*Bact. angulatum* and *Bact. tabacum*) damage began two weeks or more after it started in the fields from untreated beds, and on the whole the damage was less severe. In ordinary seasons, treatment of tobacco beds with Bordeaux mixture should give good control of these bacteria in the field.

Inoculations of dark fire-cured and air-cured tobaccos throughout the growing season in a plot low in fertility with single-colony cultures of *Bact. tabacum* or *Bact. angulatum* gave rise to the large, necrotic,

zonate spotting of blackfire. These symptoms were less frequently induced with the latter than with the former organism. Dark tobacco in a plot of medium fertility developed blackfire more readily after inoculation with *Bact. tabacum* or *Bact. angulatum* than did similar plants in a plot of high fertility. Wildfire was induced in tobacco by inoculation with *Bact. tabacum* cultures and angular leaf spot with *Bact. angulatum* cultures kept on beef-peptone agar or plain agar for $3\frac{1}{2}$ years in an ice-box.

When the lower surface of tobacco leaves was exposed to a strong stream of water a mechanical injury was produced which resembled 'moonburn', a form of leaf spot frequently observed in the field after wind and rain. The lower surface was at first roughened, and in three or four days chlorotic and necrotic areas developed. Pathogenic organisms were not necessarily associated with either the field spots or the artificially induced spotting.

Report of progress for year ending June 30, 1938.—*Bull. Me agric. Exp. Sta.* 391, pp. 233–332, 6 figs., 1938. [Received May, 1939.]

This report [cf. *R.A.M.*, xvii, p. 377] contains the following items of phytopathological interest. Three years' comparative tests by D. Folsom of the effects of two different concentrations of lime-sulphur applied to McIntosh apple trees (24 years old in 1937) against scab [*Venturia inaequalis*] showed that, taking an average of the three years' results, the trees to which the mixture was applied at full strength (1 gal. liquid lime-sulphur, or 4 lb. dry lime-sulphur, per 50 gals. of mixture) had 1·9 per cent. scabby leaves, 38 per cent. burned leaves, 2·3 per cent. scabby fruits, 2·1 per cent. russeted fruits, and a yield of 7·8 bush. per tree, the corresponding figures for the trees to which the spray was applied at half-strength being 5, 28, 6·1, and 1·9 per cent., and 8 bush. The girth increase of the trees remained about the same for both treatments.

Observations on young McIntosh trees given the same treatment against scab annually for ten years showed that those given lime-sulphur, lime-sulphur following lead arsenate for eight years, followed by lime-sulphur alone for two years, sulphur spray, sulphur dust, and no treatment (controls) had made an average increase in trunk girth during the whole period of 4·66, 4·62, 5·05, 4·25, and 4·88 cm., respectively, the average yield for 1933 to 1937 (inclusive), being, respectively, 36·3, 51·5, 63·7, 75·5, and 44·6 lb. per tree, and the ratio of yield rate 1, 1·42, 1·76, 2·08, and 1·23.

Field surveys by R. Bonde and L. Schaal of the efficiency of the treatments of potato seed pieces against *Rhizoctonia* [*Corticium solani*] made by local growers showed that in many instances the methods adopted failed to kill the larger and medium-sized sclerotia. Soaking the seed pieces in mercuric chloride (1 in 1,000) for $1\frac{1}{2}$ hours was more effective than using organic mercury compounds. Treatment in the autumn soon after digging did not injure the seed tubers and gave good control of infection, yield comparing favourably with that of tubers treated in the spring. In an investigation of the prevalence of *C. solani* in the soils of Aroostook County, Irish Cobbler potatoes selected as clean in the autumn were treated by prolonged soaking and planted on 34 different

farms. In 14 fields no disease developed; fields heavily cropped with potatoes for several years gave the heaviest tuber infection; tubers on virgin soil showed no infection; and fields previously cropped with hay or clover for two years were unaffected.

Applications to the soil of mercuric chloride and yellow oxide of mercury, each at the rate of 6 lb. per acre, 'zinc-mercury amalgam', formacide (6 lb.), and naphtha flakes (77 lb.) were made in two experiments to (*a*) soil heavily infected with *C. solani*, using healthy seed potatoes, and (*b*) soil relatively free from *C. solani*, using infected seed tubers. The results demonstrated that the three mercury compounds considerably reduced infection from both soil and tubers, and also significantly diminished the number and size of the sclerotia. Russeting of the skin was controlled, and the tubers when dug were brighter and more attractive than those from the control plots. On the other hand, the plants were stunted, and their growth was retarded and yield much reduced, though they gradually recovered from the dwarfing. The 'zinc-mercury amalgam' had a less toxic effect on growth than did mercuric chloride and yellow oxide of mercury. Formacide and naphtha flakes gave little control.

Ten years' studies by R. Bonde on Aroostook Farm showed that in normal years the spread of potato leaf roll, spindle tuber, and rugose mosaic is negligible. In 1937, however, mild mosaic, leaf roll, spindle tuber, and rugose mosaic were widely disseminated, the Katahdin variety being least affected. Harvesting before 1st September largely avoided these virus diseases. The abnormal spread of leaf roll in 1937 is largely attributed by G. W. Simpson to the presence in large numbers of *Myzus persicae*. Most of the spread appeared to occur from hill to hill. Leaf roll potatoes should be removed from the field in bags and disposed of in some place as far away as the rogued field is from other potato fields.

When colonies of *Myzus persicae* were reared on leaf roll plants and transferred to healthy hills (all of which were thinned to a single stalk) in lots of 1, 5, 10, 25, 50, 100, and 1,000±, the numbers of single stalk hills inoculated being 8, 56, 8, 8, 8, 8, and 4, infection occurred in 0, 52, 8, 8, 8, 8, and 4 hills respectively. A similar experiment with *Macrosiphum solanifolii* gave completely negative results.

KEUCHENIUS (A. A. M. N.). **Overzicht van de ondernemingscultures in het rayon West-Sumatra gedurende 1938.** [Survey of the plantation crops in the West Sumatra region during 1938.]—*Bergcultures*, xiii, 18, pp. 569–576, 1939.

Cinchona in reclaimed forest clearings in West Sumatra was attacked by the root fungi *Rosellinia bunodes*, *R. arcuata* [*R.A.M.*, x, p. 298; xvi, p. 160], a brick-red *Poria*, and *Armillaria mellea* [loc. cit.], while isolated cases of *Polyporus rubidus* [ibid., xvii, p. 162] and *Fomes noxius* [ibid., xviii, p. 137] were found. Some damage was caused among seedlings by *Rhizoctonia* [*Corticium*] *solani*. Clone RG1 showed periodical foliar infection by a *Phyllostictina*. Four-month-old plants in a sickly, backward condition were found to be invaded by *Helminthosporium* and *Fusarium*. *C. salmonicolor* [ibid., x, p. 298] was responsible for stem and branch die-back in plantings where timely thinning-out

was neglected. Both *Cinchona ledgeriana* and *C. succirubra* suffer from an obscure disease, known as stem rust, stem canker, or stripe canker, characterized by the presence on the main stems of the rust-coloured deposits of a reddish-brown exudate, and in the later stages by cankers on the bast and death of the bast, cambium, and outer xylem tissues.

Fomes noxius was the most prominent fungal parasite of coffee roots [ibid., xvii, p. 162] during the period under review.

Rubber [*Hevea brasiliensis*] in cleared areas was attacked by *Ganoderma pseudoferreum*, *F. lignosus* [ibid., xviii, p. 341], *Xylaria thwaitesii* [ibid., xvi, pp. 160, 798], and *Ustulina zonata* [ibid., xvii, p. 343]. Good control of the leaf spots caused by *Phyllosticta heveae* [ibid., xvii, p. 843], *Colletotrichum heveae* [ibid., ix, p. 64], and *Fusarium* was obtained by several applications of 0·05 per cent. cryptonol [ortho-oxyquinoline sulphate: ibid., xviii, p. 554].

The following root fungi (in order of their importance) occurred on tea: *Rosellinia bunodes* and *R. arcuata* [ibid., xvii, p. 202], *A. fuscipes* [or *A. mellea*: ibid., xvii, p. 202; xviii, p. 452], *F. noxius* [ibid., xviii, p. 504], *U. zonata* [ibid., xvi, p. 129; xviii, p. 504], *Poria* and *G. pseudoferreum*, and *Helicobasidium compactum* [ibid., xviii, p. 546]. *Asterina camelliae* [ibid., xvii, p. 162] and *Pestalozzia* [*theae*: ibid., xvii, p. 71] were prevalent on tea foliage, the former also occurring on *Albizzia falcata* and the latter on lamtoro [*Leucaena glauca*]. On one estate *C. camelliae* [*Glomerella cingulata*: loc. cit.] caused defoliation of weakened bushes eight to ten months after pruning.

Crown rot of oil palms [ibid., xv, p. 147] was more in evidence in forest clearings than on land formerly occupied by alang-alang [*Imperata arundinacea*].

SCHOONEVELDT (J. C.). **Beknopt overzicht van de meerjaarige cultures in het rayon Buitenzorg over 1938.** [A concise survey of the state of the crops of several years' standing in the Buitenzorg district in 1938.]—*Bergcultures*, xiii, 19, pp. 606–608, 1939.

Both red [*Ganoderma pseudoferreum*] and white [*Fomes lignosus*] root rots of rubber [*Hevea brasiliensis*: see preceding abstract] were observed in plantations up to nine years old on reclaimed areas, while on old estates, especially in the vicinity of Buitenzorg and Bantam, the virulence of the former organism continues unabated. Remedial measures in the form of root exposure in two rows of trees surrounding diseased individuals have been widely adopted. Good control of stripe canker [*Phytophthora palmivora*] was given by the application to the infected tissues of a mixture of Socony product 2295 A and 3 per cent. carbolineum plantarium [ibid., xvi, p. 634; xvii, p. 343]. The same mixture may be used for the protection of the cuts made in the excision of bast tissues in grafts invaded by *Diplodia* [*Botryodiplodia theobromae*] after disinfection with 20 per cent. carbolineum or 5 per cent. izal.

Red root rot [*G. pseudoferreum*] still constitutes a problem in tea plantations [see preceding abstract] where infection is spread by old wood debris in the soil or diseased *Albizzia* [*falcata*] roots. Pruned bushes were attacked through the wounds by *B. theobromae* [ibid., xvii, p. 71].

Levine (M.). **Crown gall-like tumors induced with scharlach red on the plant, Kalanchoë.**—*Proc. Soc. exp. Biol., N.Y.*, xl, 4, pp. 599–603, 4 figs., 1939.

A lanoline paste containing 1 to 2 per cent. of scharlach [scarlet] red when applied to decapitated shoots of *Kalanchoë daigremontiana* at the Montefiore Hospital, New York, induced the formation of overgrowths with leafy shoots and roots resembling the typical crown galls of *Pseudomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xviii, p. 446]. Other carcinogenic agents, e.g., 1, 2, 5, 6-dibenzanthracene, methylcholanthrene, and benzpyrene, similarly applied in lanoline, cause injuries to the treated *K.* stems without the formation of excrescences, roots being produced above and below the sites of application. Indoleacetic acid (3 per cent.) induces on the same plant a profusion of long, white roots and small, short-lived intumescences. Roots are also produced on injured *K. daigremontiana* plants treated with lanoline alone. It is concluded that root formation in these experiments (except in the case of the heteroauxin, indoleacetic acid) results from injury stimulating the plant cells to secrete root-producing substances, which are conveyed to portions of the stem above and below the treated areas.

Le principali malattie crittogamiche dei cereali. [The principal cryptogamic diseases of cereals.]—*Ital. agric.*, lxxv, 12, pp. 887–888, 1 col. pl., 1938.

Brief, semi-popular notes are given on the following cereal diseases in Italy: black, brown, and yellow rusts (*Puccinia graminis* on wheat, [*P. triticina*] on wheat, and *P. glumarum* on rye and wheat), *Helminthosporium gramineum* (barley, wheat, and oats), *Cladosporium herbarum* (general), loose smut of wheat (*Ustilago tritici*), maize smut (*U. maydis*) [*U. zeae*], and 'brusone' of rice (*Piricularia oryzae*) [*R.A.M.*, xvii, p. 61; xviii, p. 546].

Stevens (N. E.). **Disease, damage and pollination types in 'grains'.**—*Science*, N.S., lxxxix, 2311, pp. 339–340, 1939.

In this note the author suggests that the amount of matter published on various diseases of economic crops indicates their relative economic importance, and gives disease indices for grain crops of the U.S.A. for the period 1910 to 1919 obtained by dividing the number of pages published by the value of the crop concerned in millions of dollars: flax 14·2, rice 4·9, barley 3·5, wheat 3·4, sorghum 2·3, oats 1·8, rye 1·5, maize 0·8, and buckwheat 0, while the figures computed on the same basis for fruit and potatoes were over 30 and over 20, respectively. Attention is drawn to the striking correlation between the high disease indices and self-pollination, and low indices and cross-pollination.

Fedorintchik (N. S.). **Darluca filum (Cast.)** в борьбе с ржавчиной. [*Darluca filum* (Cast.) in the control of rust].—*Pl. Prot., Leningr.*, *1939*, 18, pp. 61–70, 5 figs., 1939. [English summary.]

Pycnidia of *Darluca filum* [*R.A.M.*, xvi, p. 279] were observed on the pustules of various rust fungi on cereals and also sometimes directly on the leaves of the host plants. When wheat plants in pots were inoculated

with *D. filum* either simultaneously with, or following inoculation by, *Puccinia triticina*, the plants became infected with *D. filum*, whereas those inoculated with *D. filum* only showed no signs of infection. It is concluded that *D. filum* is parasitic on the rusts but not on the host, and that it feeds both on the rust spores and on the intercellular mycelium. The spores of *D. filum* began to germinate after three hours at temperatures from 15° to 25° C. The optimal temperature for germination was 20° to 21°, but large numbers of spores germinated at temperatures between 12° and 26°. It is pointed out in this connexion that the temperature conditions of almost all districts of the Soviet Union where rusts are distributed would be favourable for the development of the fungus. The incubation period of *D. filum* at a mean daily temperature of 22·4° and relative air humidity of 70 to 100 per cent. was nearly the same as that of *P. triticina*, namely, five to six days; at temperatures from 8° to 35° it varied from four to seven days. Artificial infection with *D. filum* material from rust of wheat was successful on *P. dispersa* [*P. secalina*] on rye, *P. simplex* [*P. anomala*] on barley, *P. graminis* on oats, and *P. coronifera* [*P. coronata*] on oats and *Agropyron repens*. In nature *D. filum* was found to develop most intensely under conditions of high relative humidity, principally in low-lying sites and during spring and autumn. In order to obtain sufficient amounts of *D. filum* for inoculation under field conditions, a nursery of wheat plants infected with rust was established, but the material obtained was never quite free from rust and was, therefore, considered unsuitable. Good results were obtained in preliminary tests with infected wheat leaves dried at a temperature of 30° and a relative humidity of 30 per cent. for 20 days, when the rust uredospores lost their viability but the pycnidia of *D. filum* survived and could then be used for inoculation in form of a water suspension, sprayed at the rate of 100 l. per hect.

Tupenevitch (S. M.) & Shirko (V. N.). Мероприятия по борьбе с гибелью озимых весной от **Sclerotinia graminearum Elen.** [Measures for preventing losses of winter cereals in the spring from *Sclerotinia graminearum* Elen.]—*Pl. Prot., Leningr., 1939*, 18, pp. 85–99, 5 figs., 1939. [English summary.]

Losses of winter cereals due to *Sclerotinia graminearum* [*R.A.M.*, xvi, p. 526 and next abstracts] amounted in 1936 to 2·95 per cent. of the area sown in the Kirov region of the U.S.S.R. and to 3·31 per cent. in the Udmurtskaya Autonomous Soviet Republic. Sclerotia of the fungus develop on the leaves as well as inside the stems of the plants. Die-back of the plants occurs after thawing of the snow and also somewhat later during growth. On well-cultivated soils some plants recover and give normal yields, whereas on poor soils partially recovered plants usually die in a later stage. Germination of the sclerotia in nature takes place in autumn and requires light, high humidity of soil surface (about 70 per cent.), and not too high average day temperatures (1·2° to 12° C.). Young sclerotia do not germinate. Mature sclerotia which fail to germinate in the autumn of the first year are capable of overwintering and germinate in the autumn of the following year. The development of the mycelium of the fungus in nature occurs at a temperature little above 0° and under conditions of high air humidity. The fungus infects

winter wheat and rye, timothy [*Phleum pratense*], French rye grass [*Arrhenatherum avenaceum*], and other grasses, but has not been observed to attack summer crops. The recommendations for the control of the disease include crop rotation; application of manure and other organic fertilizers (composted turf, green lucerne); liming of acid soils; draining of excessively moist fields and accelerating the melting of snow by scattering fine peat over it; deep and early ploughing of fields where winter crops were badly affected by the disease in order to prevent germination of sclerotia in the autumn; eradication of susceptible cereal weeds; harrowing of winter sowings in the spring; burning of dry leaves with sclerotia collected during harrowing; and growing of resistant varieties. In 1934, during a serious outbreak of the disease, the varieties Erythrospermum 0529 and Lutescens 0116 appeared to be very resistant.

Solkina (Mme A. F.). К изучению цикла развития гриба **Sclerotinia graminearum Elen.** [A study of the cycle of development of the fungus *Sclerotinia graminearum* Elen.]—*Pl. Prot., Leningr., 1939*, 18, pp. 100–108, 1 fig., 1939. [English summary.]

In a study on *Sclerotinia graminearum* [see preceding and next abstracts] the fungus was grown on beer wort-peptone agar and on sterile grain. The mycelium began to grow six days after sowing the ascospores, and sclerotia (somewhat larger than in nature) developed 19 days later. At about the same time a microconidial stage was formed, and apothecia appeared about four months after sowing. A comparison of the fungus with related species revealed a certain similarity to *S. borealis* [*R.A.M.*, xviii, p. 298], but on the whole seemed to justify the opinion of P. F. Eleneff, who first named *S. graminearum* in 1919 (according to his account the fungus was first found in 1901 by Mme N. I. Troussova), that it represents a distinct species. It is suggested, however, that pending further studies the systematic position of the fungus should not be considered as finally established. No description of the fungus having been published by previous workers, a Latin diagnosis is now furnished. The apothecia of the fungus are at first cyathoid, then flattened, with a cylindrical stipe, up to 15 mm. long. The disk is 2·5 to 6 mm. in diameter and yellowish-brown. The eight-spored asci are cylindrical with rounded ends, 175 to 300 by 10 to 14 μ (average 225 by 13 μ), the apical pore staining blue with iodine. The spores are uniseriate, hyaline, inequilateral, 16 to 23 by 7 to 10 μ (average 18 by 8 μ). The paraphyses are filiform, slightly broadened at the apices, and hyaline. The microconidia are globose, 2 μ in diameter, hyaline, and uniguttulate, and the conidiophores are irregularly branched. The sclerotia are tuberiform, black, 1 to 6 by 1 to 3 mm.

Experiments under natural conditions showed that the germination of the sclerotia was adversely affected by storing for seven to ten months in a dry state. Germinating sclerotia dried to an air-dry condition and stored for 2½ months continued to germinate normally when again exposed to moisture. The asci are formed mainly in autumn subject to a favourable combination of humidity and temperature. The optimum temperature for ascospore germination is 3° to 16° C., the process declining at higher temperatures and ceasing altogether at 30°, while freezing to −3° did not kill the spores.

Yakovleff (A. G.). **К изучению биологии склеротинии на озимых (Sclerotinia graminearum Elen.).** [A study of the biology of *Sclerotinia graminearum* Elen. on winter cereals].—*Pl. Prot., Leningr., 1939*, 18, pp. 109–112, 1 fig., 1939. [English summary.]

In germination experiments with *Sclerotinia graminearum* [see preceding and next abstracts] it was shown that a period of exposure to sunlight is necessary for the germination of the sclerotia of the fungus. Sclerotia allowed to ripen in the field during the summer and collected in the autumn germinated up to 20·5 or 27·7 per cent., while of those collected in the spring not more than 2 per cent. germinated. Germinating sclerotia showed positive phototropism. Under conditions of insufficient light on short December days the apothecia yielded no spores. In nature the sclerotia form bright yellow apothecia. The fungus develops most profusely on highly acid soils.

Fokin (A. D.). **Метеорологические условия массовых вспышек склеротинии на озимых (Sclerotinia graminearum Elen.).** [Meteorological conditions governing mass outbreaks of *Sclerotinia graminearum* Elen. on winter cereals.]—*Pl. Prot., Leningr., 1939*, 18, pp. 113–120, 5 graphs, 1939.

A study of the meteorological data of the Kirov region of the U.S.S.R. showed that the autumns preceding serious outbreaks of *Sclerotinia graminearum* [see preceding abstracts], which occurred in 1903, 1909, 1934, and 1936, were characterized by very high relative humidity (maximum 100, minimum 70 to 80 per cent.). It is suggested that during warm, moist autumn weather, the sclerotia germinate and infect the young plants by ascospores or mycelium; the subsequent fall of temperature and the first night frosts weaken the infected plants, the following cool weather and heavy precipitations favour the development of the fungus inside the plants, which thus enter the snow period in a very weakened condition. The short period between the melting of the snow and the formation of sclerotia, which is believed to be the final stage in the life-cycle of the fungus, is not favourable to its development, as the humidity of the air at that time rarely exceeds 50 to 60 per cent. It is not considered, for that reason, to be a decisive phase in the pathogenic activity of the fungus. The death of the plants may be due to either meteorological factors during the winter or to the ability of the fungus to develop at low temperatures under the snow.

Bever (W. M.). **Reaction of Wheat, Barley, and Rye varieties to stripe rust in the Pacific Northwest.**—*Circ. U.S. Dep. Agric.* 501, 15 pp., 1938. [Abs. in *Exp. Sta. Rec.*, lxxx, 5, p. 639, 1939.]

The author carried our field and greenhouse studies on the reaction to *Puccinia glumarum* [*R.A.M.*, xviii, p. 300] of 317 wheat varieties grown in the United States and 1,284 foreign introductions, 365 barley, and 11 rye varieties. The greenhouse experiments were confined to seedling reactions, those in the field to the soft-dough stage. Physiologic race 19 provided the inoculum in the greenhouse tests, and field infection was obtained from natural sources.

Of the commercial winter wheats the most resistant were Blackhull, Cheyenne, Kanred, Oro, Ridit, and Turkey (C.I. 6175) in the hard red winter class, and Fulhio, Nittany, and Red Rock in the soft red winter class. The Defiance, Dicklow, and Irwin Dicklow white spring wheats, and the Democrat, Eaton, Hard Federation × Martin, and Rex selection (C.I. 11689) white winter wheats were resistant. The Club wheats were the most susceptible, only Big Club being resistant in both the seedling and soft-dough stages. Of 14 durum wheats studied, only Kubanka, Mindum, and Monad were susceptible in the field, Mondak and Nodak being susceptible only in the seedling stage. Approximately half the 365 barley varieties tested in the greenhouse showed an immune type of reaction, while Winter Club, Hannchen (C.I. 602), Meloy, Horsford, and Wisconsin Pedigree 38 barleys were resistant. All the rye varieties tested except Prolific Spring were immune or resistant.

VALLEGA (J.). **Dos nuevas selecciones de Trigo de origen hibrido imunes a 'Puccinia glumarum'.** [Two new Wheat selections of hybrid origin immune from *Puccinia glumarum*.]—*Rev. Fac. Agron., La Plata*, Ser. 3, xxii, pp. 139–145, 1938. [Received July, 1939.]

Particulars are given of two wheat selections, I.F. 301 and I.F. 293, resulting from hybridization between the Chino 166 winter wheat and Lin Calel, a common Argentine native variety, which have inherited the immunity from yellow rust (*Puccinia glumarum*) [*R.A.M.*, xiv, p. 500] of the male parent and are likely to prove of great use in further breeding operations.

MAKLAKOVA (Mme G. F.). Оценка агротехнических приемов как мероприятия против ржавчины Пшеницы. [Estimation of agrotechnical methods as measures against Wheat rust.]—*Pl. Prot., Leningr., 1939*, 18, pp. 77–84, 1 graph, 1939. [English summary.]

Field investigations carried out by the Pan-Soviet Institute of Plant Protection in various parts of the Union showed that the application of fertilizers (particularly stable manure at the rate of either 40 or 20 zentner [2,000 or 1,000 kg.] per hect. or complete artificials) considerably increased the yields of summer wheats, but had little effect on the incidence of brown rust (*Puccinia triticina*), on which the date of sowing, on the other hand, exerted a considerable influence. In the Voronezh district the incidence of brown rust on unfertilized plots of summer wheat Caesium 111 sown on 14th April was 10·9 per cent. on 7th July, 22·5 per cent. on 18th July, and 75 per cent. eight days later, while the corresponding figures for wheat sown on 4th May were 16·2, 41·6, and 93·3 per cent. On fertilized plots the incidence was considerably lower than on unfertilized ones in the earlier sown and equally high in the later sown wheats. The yields amounted to 14·2 and 8·4 zentner per hect., respectively, in the earlier sown, and to 9·3 and 7·1, respectively, in the later sown wheats. Similar results were obtained with summer wheats in the Leningrad district. Winter wheats sown early were more intensely attacked by rust, but yielded considerably more than later sown ones.

Barmenkoff (A. S.). Оценки поражаемости стандартных и перспективных сортов Пшеницы наиболее распространенными в СССР расами **Puccinia triticina Erikss.** [Evaluation of the damage caused to the standard and new Wheat varieties by the most widespread races of *Puccinia triticina* Erikss. in the U.S.S.R.]—*Pl. Prot., Leningr., 1939*, 18, pp. 158–161, 1939.

Of the 79 winter and summer standard wheat varieties artificially infected at an early stage of growth with the eight most common races of *Puccinia triticina* in the U.S.S.R. [*R.A.M.*, xvii, pp. 436, 437], only two (Kanred×Fulcaster 266319 and 266287) proved to be highly resistant to all eight races (Nos. 10, 13, 20, 17, 65, 66, 67, and 69), while 60 were highly susceptible and 17 varied in their reaction to the different races.

Pal (B. P.) & Mundkur (B. B.). **Studies in Indian cereal smuts. I. Cereal smuts and their control by the development of resistant varieties.**—*Proc. Indian Acad. Sci.*, Sect. B., ix, 5, pp. 267–270, 2 pl., 1939.

After pointing out that cereal smuts in some years cause great loss in certain parts of India, the authors present some introductory notes on systematic efforts to study the resistance of the different cereals to their respective smuts and to develop new resistant varieties that have recently been begun at Delhi. It has already been ascertained that the spores of covered smut of oats (*Ustilago kolleri*), when kept under laboratory conditions at Delhi and Pusa, lose their viability in three or four months. The spores of covered smut of barley (*U. hordei*), on the other hand, have remained viable under the same conditions for four years, with no loss in germinability. Evidence has been obtained that resistance trials are of no practical value unless at least 60 to 70 per cent. infection is induced on the susceptible varieties used. In the authors' work, 100 per cent. infection by loose smut (*U. tritici*) was secured on certain wheats, e.g., Punjab C. 591, while a few, including Pusa 114 and Pusa 165, were completely resistant.

Fellows (H.) & Ficke (C. H.). **Soil infestation by Ophiobolus graminis and its spread.**—*J. agric. Res.*, lviii, 7, pp. 505–519, 1 diag., 1939.

The results of pot experiments on the mode of spread of take-all of wheat (*Ophiobolus graminis*) [*R.A.M.*, xviii, pp. 241, 515] in the soil showed that in the greenhouse at least 25 per cent. by volume of infested soil had to be incorporated in a mixture of infested and uninfested soil in order to produce an appreciable amount of disease in Kanred wheat. In a mixture containing 30 per cent. infested soil the infestation increased in five successive wheat crops, while no increase was observed after four years with a 15 per cent. dosage. It is assumed that in the field an even greater percentage of infested soil would be required to produce serious damage, though the infestation in both mixtures was much greater than would occur by soil transference under natural conditions. The addition of water suspensions of infested soil to non-infested produced infection in the greenhouse when cropped with wheat during two years.

In the field a light sprinkling of non-infested soil with infested soil, to simulate wind blowing, failed to produce infection during three years' cropping, but when the same soil was removed to the greenhouse the second crop grown on it became diseased. No spread of infection occurred when infested and non-infested soils were placed in contact without mixing, but infection took place when wheat roots were allowed to penetrate both soils, more infection being spread both laterally and vertically when the roots grew from non-infested into infested soil than in the opposite direction. Infested soils were found to lose their infestation when brought into contact with non-infested soils in the field or greenhouse, and infestation seems also to disappear from affected spots in the field. In the greenhouse infection resulted from mixing stubble and roots from diseased plants with sterilized soil or placing perithecia of the fungus on the surface of the soil near the base of wheat plants, but no disease developed in field experiments. Infection lasting for five years was obtained in both greenhouse and field with cultures of the fungus grown on a barley-oats medium. It is concluded from these results that the infected roots of the living plant are probably the best carriers of infection to non-infested soil, and this explains why crop rotation is an effective measure of control, particularly in the Middle West of the United States.

Bockmann (H.). **Möglichkeiten zur Verhütung der Halmbruchkrankheit bei Getreide.** [Possibilities of control of the straw-breaking disease of cereals.]—*Pflanzenbau*, xv, 11, pp. 403–430, 6 figs., 1939.

This is a comprehensive, fully tabulated account and discussion of the writer's experiments in Schleswig-Holstein on the control of straw-breaking or [eyespot] lodging in wheat (Peragis summer and Carsten V and Mahndorfer Tempo winter) caused by *Cercosporella* [*herpotrichoides*: *R.A.M.*, xviii, p. 448] by the regulation of sowing operations in respect of density, depth, and time. The first-named is the most important of the three factors. No hard-and-fast rule can be laid down for the quantity of seed-grain to be used, since the local environmental conditions vary greatly, sometimes even from one farm to the next: a rate of 160 kg. per hect., however, may serve as the normal standard, to be reduced where outbreaks of the disease are known to threaten. Shallow ($\frac{1}{2}$ to 1 cm.) and late (middle of October to mid-November) sowing are contributory measures towards the lessening of infection, but their beneficial effects are not so clear-cut or well-established as those of a normal to thin planting rate.

Frickhinger (H. W.). **Die Federbuschsporen-Krankheit.** [The plumed spore disease.]—*Dtsch. landw. Pr.*, lxvi, 14, p. 176, 1939.

A semi-popular note is given on the plumed spore disease [twist] of cereals (chiefly wheat and spelt, though rye and oats are also liable to infection) caused by *Dilophospora alopecuri* [*R.A.M.*, xvi, p. 184], which was first observed in Germany after the world war, since when it has been responsible from time to time for losses of up to 30 per cent. of the crops in various parts of the country.

Shitakova-Roussakova (Mme A. A.). Поражаемость сортов Ржи пятнистой болезнью **(Scolecotrichum graminis Fuckel)** в условиях Отрады Кубанской. [The susceptibility of Rye varieties to the spot disease (*Scolecotrichum graminis* Fuckel) under conditions of the Otrada-Kuban selection farm.]—*Pl. Prot., Leningr., 1939*, 18, pp. 71–76, 1 fig., 1939. [English summary.]

Field observations in 1931 showed that some rye varieties had suffered rather seriously from the spot disease caused by *Scolecotrichum graminis* [*R.A.M.*, xii, p. 395]. At the end of the flowering stage the fifth leaves (counting from the top) were affected up to 0·7 of their surface, the third up to 0·4, and even the second and the top leaves were slightly injured (0·01 of the leaf surface). Of the rye varieties tested Lissitzinskaya, Vyatskaya, and Rosen were the most intensely, and Tarashtshanskaya and Petkuskaya the least affected, an average of 0·5 of the surface of all leaves being injured in the first three and 0·2 in the last two varieties. After the end of the flowering stage (30th May) the lower leaves gradually dried up and the spotting became less conspicuous and disappeared entirely by 20th June. The disease is believed to be potentially harmful in years favouring its development, particularly in northern districts of the Soviet Union where it may become not less serious than rusts. The disease is fairly widely distributed throughout the Union.

Kuprewicz (V. F.) & Khilimonova (Mme V. I.) К биологии листовой ржавчины Ржи **Puccinia dispersa Erikss.** [On the biology of leaf rust of Rye, *Puccinia dispersa* Erikss.]—*Sovetsk. Bot., 1939*, 1, pp. 98–99, 1939.

The results of field investigations carried out from 1934 to 1936 in the Minsk district of the U.S.S.R. showed that uredospores of brown rust of rye (*Puccinia dispersa*) [*P. secalina*: *R.A.M.*, xiv, p. 292] can withstand a temperature of —26° C. under loose and dry snow, but perish when excessive soil moisture induces the formation of an ice cover. With the advent of the first warm days in spring the proportion of living uredospores is drastically reduced. Uredospores collected from under snow on 22nd January, 18th and 28th February, and 7th March gave 87 to 90, 44 to 48, 10, and about 0·1 per cent. germination, respectively, whereas in the case of uredospores on leaves frozen in the ice cover only those collected on the first date germinated up to 30 to 35 per cent., and none of those collected on later dates. No living spores were subsequently found till 5th May, when a few uredosori were observed on the dying leaves nearest to the ground [cf. ibid., xiii, p. 82].

Reed (G. M.). **Reports on research for 1938. Plant pathology.**—*Rep. Brooklyn bot. Gdn, 1938* (*Brooklyn bot. Gdn Rec.*, xxviii, 2), pp. 47–51, 1939.

In further studies on the inheritance of resistance of oat hybrids to loose and covered smuts [*Ustilago avenae* and *U. kolleri*, respectively: *R.A.M.*, xvii, p. 451] the hybrid of Green Mountain × Monarch was used. Both parents are susceptible to the Missouri race of *U. kolleri*, while one,

Monarch, is resistant to the Missouri race of *U. avenae*. All the F_2 plants were susceptible to the former whereas only 25 per cent were infected by the latter and by a new physiologic race of *U. kolleri* to which Monarch is susceptible.

In further infection studies by L. G. Utter with 13 new races resulting from hybridization between loose and covered smuts of oats [ibid., xvii, p. 15], the covered smut types gave up to 100 per cent. infection on Gothland and other varieties. Monarch was fully resistant to all races except one, which gave 40 per cent. infection. From 63 to 100 per cent. infection was obtained on Monarch with the loose smut types, Gothland was fully resistant to three of them, and both Monarch and Gothland became 100 per cent. infected by one race. As Gothland is normally resistant to covered smut but susceptible to loose smut, while the reverse obtains with Monarch, the new races selected show distinctive recombinations for symptoms, morphology, and pathogenicity.

In further work by D. Elizabeth Marcy on the effect of conditions of seedling germination on sorghum infection by covered kernel smut [*Sphacelotheca sorghi*: ibid., xvi, p. 666], using the very susceptible Dakota Amber Sorgo variety, it was found that seedlings germinated in fine sand at 17·5° and 22·5° C. showed a higher percentage of infection than others germinated in coarse sand in 12 out of 14 different combinations of seedling environmental conditions. When the germination temperature was maintained at 27·5° the percentages of infection were lower in fine sand with one exception. With the semi-resistant variety Feterita a slightly higher percentage of infection was generally obtained in fine than in coarse sand.

Stevens (N. E.) & Haenseler (C. M.). **Fifth experimental forecast of the incidence of bacterial wilt of Sweet Corn.**—*Plant Dis. Reptr*, xxiii, 6, pp. 99–104, 1 graph, 1 map, 1939. [Mimeographed.]

A survey of the incidence of bacterial wilt of maize (*Aplanobacter stewarti*) in the United States in 1938 illustrated the general reliability of the method of predicting outbreaks of the disease in a given season on the basis of the preceding winter temperatures [*R.A.M.*, xvii, p. 105], though deviations from the expected developments in certain regions suggest the operation of additional controlling factors requiring further study. The winter of 1938–9 was slightly warmer than that of 1937–8 and somewhat colder than 1936–7, suggesting the probability of commercially significant losses during the summer of 1939 as far north as Rockland County, New York, and Indianapolis, Indiana. In fact, the cumulative deleterious effect on the crop of three mild winters may well result in heavier damage than that sustained in the two previous years.

Cornoldi (G.). **Ingiallimento ed afidi nelle giovani piante di Sorgo zuccherino.** [Yellowing and aphids on young plants of saccharine Sorghum.]—*Industr. saccar. ital.*, xxxii, 3, pp. 145–147, 1939.

A planting of saccharine sorghum [*Sorghum* (?) *bicolor*] at Bottrighe, Italy, became infected in 1938 by a chlorotic disease, to which succeeded severe aphid infestation, especially of the yellow leaves. The normal green foliage of plants in various stages of development was found by analysis to contain 0·5, 0·36, 0·21, and 0·135 per cent. hydrocyanic acid,

the corresponding figures for the chlorotic leaves being 0·045, 0·032, 0·026, and 0·014. Observations on the reaction to the disease of 52 varieties showed 50 to 100 per cent. infection in 28, 10 to 45 per cent. in 19, and 5 per cent. in 5 (Atlas, Gooseneck, Iceberg, Ambrosia, and Gooseneck Rosso).

MOURASHKINSKY (K. E.). Новый пиреномицет на Просе. [A new Pyrenomycete on Millet.]—*Trans. Omsk Inst. Agric.*, xvi, 1 fig., pp. 103–104, 1938. [Received July, 1939.]

An account [with a Latin diagnosis] is given of *Melanomma panici miliacei* n.sp., found in 1934 on the grain of millet [*Panicum miliaceum*] in West Siberia. Infected seeds failed to germinate and quickly became covered with an abundant white mycelium, later turning a pinkish violet. The fungus has black, carbonaceous perithecia, 450 to 520 by 400 to 430η, asci 120 to 140 by 12 to 15μ and dark brown ascospores, oblong, ellipsoid, sometimes slightly curved, triseptate, contracted at the septa, 32 by 6·2 (30 to 34 by 5·5 to 7)μ. Its pathogenicity was proved by inoculation experiments. The fungus appeared to be a weak parasite, causing debility and die-back of weak millet plants but having no noticeable effect upon vigorous ones. Perithecia were produced on sterilized ears of wheat.

VAN DER PLANK (J. E.) & RATTRAY (J. M.). **Two new disinfectants for Citrus.**—*Citrus Grower, 1939*, 65, pp. 13–14, 1939. [Abs. in *Chem. Abstr.*, xxxiii, 12, p. 4731, 1939.]

Sodium *o*-phenyl phenate at concentrations of 0·3 to 0·5 per cent. and weak solutions of sodium *o*-phenyl phenol were found [in South Africa] to be effective as citrus fruit dips for green mould [*Penicillium digitatum*] control. Neither solution injures the fruit. The alkalinity of the sodium *o*-phenyl phenate solution requires constant watching, which is not necessary for the sodium *o*-phenyl phenol treatment, the success of the latter depending on the temperature of the dip and the period of immersion of the fruit. The use of sodium *o*-phenyl phenate as a general packhouse disinfectant against *P. digitatum* is regarded as a very promising line of control.

CARVAJAL B[ARAHONA] (F.). **'Ojo de gallo' (Omphalia flavida).** [Cock's eye (*Omphalia flavida*).]—*Rev. Inst. Def. Café Costa Rica, Suppl.* vii, 52, 40 pp., 12 figs., 1939.

In the course of a full account of the coffee leaf spot caused by *Omphalia flavida* [*R.A.M.*, xvii, p. 314] in Costa Rica, where the disease is stated to be very prevalent, with periods of special recrudescence of severity at intervals of about 14 years, the author states that in 1938 he collected in the San José province abundant naturally infected material bearing fructifications of both the imperfect and perfect stages of the fungus, in some cases in association on the same leaves or berries. The sporophores fully agreed with the description of Maublanc and Rangel [whose Latin diagnosis is reproduced]. The development of the perfect stage in nature is considered to have been stimulated by the high humidity, dense shade provided by the cover plants, and proximity

to running water in the plantations in which it was found. Observations indicate that *O. flavida* may attack any green plant growing close enough to the soil to ensure sufficient humidity, and a list is given of over 100 host plants, belonging to more than 50 families, on which it has been so far actually found. While a fully effective means of controlling the disease is not yet known, the damage may be minimized by strict sanitation of the plantations, wider spacing of the coffee bushes, ensuring better circulation of air, and generally all measures directed towards reducing the humidity of the environment, and increasing the vigour of the coffee, such as adequate dressings of stable and artificial manures. Periodical spraying of the plantations with Bordeaux mixture (5 lb.–6 lb.–200 l. plus 4 lb. yellow soap), is also recommended.

ROGERS (C. H.). **The relation of moisture and temperature to growth of the Cotton root rot fungus.**—*J. agric. Res.*, lviii, 9, pp. 701–709, 2 figs., 1939.

Details are given of controlled experiments in Texas, in which *Phymatotrichum omnivorum* [*R.A.M.*, xviii, pp. 106, 175] was grown in Houston black clay soil with a soil moisture content varying from 15 to 35 per cent., oven-dry basis. The optimum content for growth was about 25 per cent., equivalent to 35 per cent. of the maximum water-holding capacity of the soil. The fungus produced sclerotia at soil moistures from 15 to 30 per cent., but neither sclerotia nor mycelial strands developed at or below 8 or above 35 per cent. In constant temperature baths both the mycelial strands and sclerotia were formed at temperatures between 11° and 37° C., the optimum for both being approximately 27°. Though there was no active growth at 3°, the lowest temperature tested, the fungus was not apparently injured; it was killed at 39° or above. At the lower temperatures the sclerotia and mycelial strands were of a whitish-amber colour, which was retained by both formations throughout the experiment at the minimum temperature permitting growth; at higher temperatures both were formed with the usual dark colour of maturity as found in the field. These results are held to indicate that soil moisture is the limiting factor for the growth and spread of *P. omnivorum* in the field during the vegetative period.

REA (H. E.). **The control of Cotton root rot in the Blackland region of Texas.**—*Bull. Tex. agric. Exp. Sta.* 573, 36 pp., 1939.

In the so-called 'blackland' region of Texas, cotton root rot due to *Phymatotrichum omnivorum* [see preceding abstract] is very destructive, all conditions being favourable to the fungus. The spread of the disease into a previously uninfected part of a cotton field may be arrested by a barrier of sorghum at least 30 ft. wide. Under local conditions the most suitable and highly effective control is given by rotation with non-susceptible crops, the cotton being grown during only one-quarter of the period of rotation. The period between the cotton crops must be at least two years. The control of susceptible weeds is a prerequisite to control by rotation. The cotton yields obtained in rotated areas are higher than in others. At Temple, the less often cotton was planted the greater were the increased yields, and the more effective the control.

TIMONIN (M. I.). **Pathogenicity of Beauveria bassiana (Bals.) Vuill. on Colorado Potato Beetle larvae.**—*Canad. J. Res.*, Sect. D, xvii, 4, pp. 103–107, 1 fig., 1939.

Beauveria bassiana [*R.A.M.*, xviii, p. 521] was isolated in New Brunswick from dead larvae of the Colorado potato beetle (*Leptinotarsa decemlineata*) and its pathogenicity proved by inoculations. Some of the infected larvae successfully passed into the pupal stage but perished a few days later. Although some evidence indicated that the fungus does not attack the eggs, infected young larvae were found dying on the fourth day after hatching from eggs dusted with the conidia of the fungus, and it would appear, therefore, that the larvae of *L. decemlineata* are susceptible to the fungus at any stage of their development.

URBAIN (A.) & GUILLOT (G.). **Les aspergilloses aviaires.** [Avian aspergilloses.]—*Rev. Path. comp.*, xxxviii, 503, pp. 929–955, 1938. [Abs. in *Bull. Inst. Pasteur*, xxxvii, 10, pp. 609–610, 1939.]

This work is described by J. Magrou as an excellent survey of avian aspergilloses. Following a historical outline of the subject, the authors successively discuss the botanical characters of *Aspergillus* and the symptomatology, pathological anatomy, diagnosis, etiology, and pathogenesis of the diseases of birds caused by fungi of the genus. In conclusion some observations are made on immunization, prophylaxis, therapy, and transmission to man, and an eight-page bibliography is appended.

BØE (J.), HARTMANN (O.), & THJØTTA (T.). **A serological study of Aspergillus fumigatus.**—*Acta path. microbiol. scand.*, xvi, 2, pp. 178–186, 1939.

Ten strains of *Aspergillus fumigatus*, isolated from the lungs of grouse [cf. *R.A.M.*, xviii, p. 109] killed by the fungus in Norway, were grown in pure culture on tomato juice agar and found to be highly pathogenic to rabbits and guinea-pigs. Rabbits treated with large quantities of antigen (7,400,000,000 spores or 100 mg. mycelium per animal) yielded sera rich in complement-fixing antibodies. Titres up to a dilution of 1 : 1,600 were registered. No serological differences between the several strains of the fungus were apparent.

TIFFNEY (W. N.). **The host range of Saprolegnia parasitica.**—*Mycologia*, xxxi, 3, pp. 310–321, 1 graph, 1939.

The results of controlled inoculation experiments showed that *Saprolegnia parasitica* [*R.A.M.*, xvii, p. 319] was capable of attacking a wide range of hosts, including fish of nine different families, frogs, and salamanders, 17 new species being added to previous records. The resistance to the pathogen varied considerably in various species, and injury was found to lower the resistance in the majority of the hosts. The disease produced identical symptoms in the various fish tested. Fish were frequently observed to eat living mycelial mats of *S. parasitica* without developing intestinal mycosis. With one exception there was no evidence that the death of the host was caused by smothering. It is suggested that death may possibly be occasioned through the

destruction of tissue, the formation of toxic materials, and the dilution or dehydration of body fluids resulting from the destruction of areas of protective epidermis.

DECKER (J. J.). **Pulmonary moniliasis.**—*New Engl. J. Med.*, ccxx, 15, pp. 626–628, 3 figs., 1939.

Clinical details are given of a case of pulmonary moniliasis in a 57-year-old farm labourer, the causal organism isolated from whose sputum was identified by D. S. Martin as *Monilia* [*Candida*] *albicans* [*R.A.M.*, xviii, pp. 395, 525, 526]. The case falls into the acute category of the disease in respect of its sudden onset and rapid progression, but is believed to be unique in this group by reason of its comparatively rapid termination in complete recovery.

LANGERON (M.) & GUERRA (P.). **Remarques sur le Candida stellatoidea (Jones et Martin 1938).** [Notes on *Candida stellatoidea* (Jones & Martin 1938).]—*Ann. Parasit. hum. comp.*, xvii, 3, pp. 257–260, 1 pl., 1939.

A strain of *Candida stellatoidea* [*R.A.M.*, xvi, p. 811] received by the authors from Norway, where it had been isolated from the sputum of a patient suffering from pulmonary disease, was found to possess many of the biological characters of *C. albicans* [see preceding abstract], but to differ significantly in others. Moreover, the giant colonies did not resemble those typical of *C. albicans*, being covered with deep, regular folds radiating out from a small, central, folded zone.

It is concluded that the *C. albicans* group includes three species, viz., *C. albicans* (C. Robin, 1845), *C. triadis* (Langeron & Talice, 1932), and *C. stellatoidea* (Jones & Martin, 1938).

LONGMIRE (W. P.) & GOODWIN (C. P.). **Generalized Torula infection. Case report and review with observations on pathogenesis.**—*Johns Hopk. Hosp. Bull.*, lxiv, 1, pp. 22–40, 2 pl., 1939.

This is a very detailed account of a case of generalized *Torula* or *Cryptococcus* infection (*T. histolytica*) [*Debaryomyces neoformans*: *R.A.M.*, xviii, p. 456], involving the brain, meninges, internal organs, thyroid, and aorta, in a four-year-old coloured girl at the Provident Hospital, Baltimore. The identity of the fungus isolated in pure culture on Sabouraud's medium was established by the following features: (1) absence of gas formation in any of the five sugars inoculated, (2) weak acid formation in two (dextrose and sucrose), (3) characteristic morphology, (4) reproduction exclusively by budding, (5) no mycelium or spore formation, and (6) typical pathological changes in experimental animals inoculated subcutaneously and intraperitoneally with a heavy saline suspension of a 36-hour culture.

The size of the round, double-contoured yeasts varied from 1 or 2 to 10 to 15μ. Generally speaking, the smaller forms with wide capsules predominate in favourable environments in the test-tube, in experimental animals, and in human lesions, while the larger ones are characteristic of relatively unfavourable conditions in the culture media and in human and animal lesions in which prominent tubercle formation is induced by vigorous defence reaction. The 'fur-like' appearance of

the cells observed by Stoddart and Cutler (*Monogr. Rockefeller Inst. med. Res.* 6, 1916) in the lesions in laboratory animals was demonstrated by W. G. MacCallum in the brain and meninges of the authors' case.

HABIBI. **Étude de trois cas de Rhinosporidium seeberi en Iran.** [Study of three cases of *Rhinosporidium seeberi* in Iran.]—*Ann. Parasit. hum. comp.*, xvii, 2, pp. 103–107, 2 pl., 1939.

The presence, hitherto unknown, of *Rhinosporidium seeberi* [*R.A.M.*, xviii, p. 455] in Iran was established by the occurrence in Teheran in 1937 of two native cases, a brief clinical history of which is given, together with that of a third case from Azerbaidjan (U.S.S.R.). Contrary to S. E. Parodi, the author found that at a certain stage in their development the sporangia of the fungus are always provided with a pore, some 10μ wide, surrounded by a ring of thickened wall, through which the spores escape in small numbers; at a later stage, however, the sporangia burst wide open, owing to internal pressure.

COCHET (Mlle G.). **Sur un nouveau champignon arthrospore (Arthrographis langeroni n.g., n.sp.), agent pathogène d'une onychomycose humaine.** [A new arthrosporous fungus (*Arthrographis langeroni* n.g., n.sp.), the pathogenic agent of human onychomycosis.]—*Ann. Parasit. hum. comp.*, xvii, 2, pp. 97–102, 2 pl., 1939.

Isolations from a case in 1938 of human onychomycosis at Lille, France, yielded a fungus which in cultures on various media formed an abundant mycelium of long, slender hyphae which readily broke up into long arthrospores of the same diameter (1·6μ); there were also present in the cultures long, irregular rows of thicker, ovoid arthrospores which appeared to germinate *in situ*, forming agglomerations of spores of varying shape and size. The main distinctive feature of the fungus is considered to be the formation at the end of the long and slender hyphae of tufts of regular, squarely cut arthrospores, somewhat similar to those in the genus *Penicillium*. In consideration of these tufts the author suggests the creation for the fungus of a new arthrosporous genus *Arthrographis* and names the organism *A. langeroni* [without technical descriptions or Latin diagnoses]. Experimentally the fungus was shown to cause a mild, transient dermatomycosis in guinea-pigs and rabbits.

CASTELLO (V. P.). **Keratomycosis nigricans palmaris.**—*Rev. argent. Dermatosifilol.*, xxii, pp. 255–264, 1938. [? Spanish. Abs. in *Bull. Inst. Pasteur*, xxxvii, 10, p. 607, 1939.]

From a discoloured, dull, slightly rugose, hyperkeratinous lesion on the palm of the right hand of a 14-year-old white Cuban girl the writer isolated on Sabouraud's agar a fungus characterized by black, greenish-bordered colonies, becoming covered with a pale green 'duvet' composed of a septate mycelium, blastospores grouped in botryose formation, and septate arthrospores. It is referred to *Cladosporium wernecki* [*R.A.M.*, xv, p. 20]. Inoculation experiments on animals gave positive results.

MCMASTER (P. E.) & GILFILLAN (C.). **Coccidioidal osteomyelitis.**—*J. Amer. med. Ass.*, cxii, 13, pp. 1233–1237, 7 figs., 1939.

Based on a perusal of the relevant literature and personal observa-

tions in 24 Californian cases (average age 32, 13 fatal), the writers give an account of the bone and joint involvement, roentgenographic features, pathological and histopathological changes, and therapy of coccidioidal osteomyelitis due to *Coccidioides immitis* [*R.A.M.*, xviii, p. 527].

STORTS (B. P.). **Coccidioidal granuloma simulating brain tumor in a child of four years.**—*J. Amer. med. Ass.*, cxii, 14, pp. 1334–1335, 3 figs., 1939.

Clinical details are given of a fatal case of coccidioidal granuloma (*Coccidioides immitis*) [see preceding abstract] simulating brain tumour in a four-year-old girl at Tucson, Arizona, this being the first report of the disease from that locality.

GRECO (N. V.), BIGATTI (A.), PONCE DE LÉON (S.), GUNCHE (F. F.), & CAPURRO (J.). **Un segundo caso familiar de enfermedad (sarcomatosis) de Kaposi, con el hongo patógeno específico, el Cryptococcus haematicon.** [A second family case of Kaposi's disease (sarcomatosis), with the specific pathogenic fungus, *Cryptococcus haematicon.*]—*Sem. méd., B. Aires*, xlv, 44, pp. 989–1000, 17 figs., 1938. [French summary.]

A case is described of Kaposi's disease (sarcomatosis) in a 39-year-old man in Buenos Aires, the second in his family to contract the malady, which subsequently spread to other members. The causal organism isolated from the blood on a special medium was identified as *Cryptococcus haematicon* Greco, already described in 1936. The average diameter of the monocellular elements is 0·2 to 2μ, but longer ones (3 to 8μ) were also observed. Reproduction is effected by budding (blastospores), division (arthrospores), and nuclear fragmentation (endospores).

GRECO (N. V.), BIGATTI (A.), PONCE DE LÉON (S.), & CAPURRO (J.). **Etiología de la enfermedad de Schamberg observada en un caso.** [The etiology of Schamberg's disease observed in a case.]—*Sem. méd., B. Aires*, xlv, 50, pp. 1345–1360, 15 figs., 1938. [French summary.]

A detailed account is given of a case of Schamberg's disease in a 40-year-old man in Buenos Aires, Argentina, where only about ten persons have been treated for the malady since 1931. The pathogenic elements in the blood measure 0·5 to 7μ in diameter; reproduction is effected by budding (blastospores) and division (arthrospores). The central nucleus, 0·2 to 0·4μ, divides and gives rise to endospores. The causal organism is named *Cryptococcus haemotophilus* Greco [without a Latin diagnosis]; it is considered to be definitely implicated in the etiology of the mycotic septicaemia associated with Schamberg's disease.

MAPLESTONE (P. A.) & DEY (N. C.). **A Microsporum new to India.**—*Indian med. Gaz.*, lxxiv, 3, pp. 148–151, 1 col. pl., 3 figs., 1939.

A species of *Microsporon* hitherto unknown in India was isolated from seven cases of ringworm of the scalp, six in a girls' school at Shillong and the seventh in a Calcutta boy who had visited the infected

area. The fungus conforms in general characters to *M. ferrugineum* [*R.A.M.*, xviii, p. 523], of which it may possibly be a variant. On various standard media the colour of the cultures ranges through different shades of brown, whereas deep yellow is typical of *M. ferrugineum* proper.

RABELLO. **Sporotrichosis fungoides: eine neue klinische Form mit Kultur von Sporotrichum (Dematium) gougeroti.** [Sporotrichosis fungoides: a new clinical type with culture of *Sporotrichum* (*Dematium*) *gougeroti*.]—*Ann. bras. Derm. Syph.*, xiii, pp. 143–145, 1938. [Portuguese, with French summary. Abs. in *Zbl. Haut- u. GeschlKr.*, lxii, 6–7, p. 365, 1939.]

From unusual manifestations of sporotrichosis in the shape of hemispherical, hard nodules on the dorsal surface of the hand, forearm, and clavicular region the writer isolated *Sporotrichum gougeroti* [*R.A.M.*, xv, p. 293] in pure culture at the Rio de Janeiro University, Brazil.

ADAMS (J.) & PARFITT (E. H.). **Some factors influencing the amount of mold mycelia in butter.**—*J. Dairy Sci.*, xxii, 5, pp. 367–374, 1939.

Mould (*Oospora lactis*, *Penicillium*, *Aspergillus*, and *Mucor*) mycelium fragments in butter [*R.A.M.*, xvii, p. 680] were shown by the authors' studies at Purdue University, Lafayette, Indiana to be an index of the duration of holding, storage temperature, and oxygen relationship of the cream from which the product was made, but not a direct index of organoleptic quality of the cream. An average cream held at or below 70° F. for six days produced a butter positive for mould mycelia in less than 40 per cent. of the fields examined, whereas a sample kept for four days at 80° yielded a product with 80 per cent. of the fields positive. There was no significant difference in the grading, in respect of moulds of the butter obtained from cream held for six and twelve days with limited and unlimited air supplies. The milk fat content of the cream exerted a slight influence on mycelial development, which was lower in nine out of ten tests in samples made from cream testing 45 per cent. than in those from cream with a 15 per cent. milk fat content. In general, the percentage of mould mycelium retention in butter ranged from 20 to 30. None of the manufacturing operations investigated significantly influenced the mould mycelium content of the butter.

GARASSINI (L. [A.]). **Ubicación generica del micromicete que produce el 'pasmo' del Lino.** [Generic position of the fungus producing 'spasm' of Flax.]—*Rev. Fac. Agron., La Plata*, Ser. 3, xxiii, pp. 95–107, 6 figs., 2 graphs, 1938. [French and German summaries. Received July, 1939.]

The spores of the agent of flax 'spasm' in the Argentine, referred by Spegazzini to *Phlyctaena* (?) *linicola* (= *Septoria linicola* (Speg.) Garassini) [*R.A.M.*, xv, p. 441; and regarded by Wollenweber as the pycnidial stage of *Sphaerella linorum*: ibid., xviii, p. 112], are definitely known from the relevant literature and the author's numerous microscopic observations to be septate, a characteristic feature of *Septoria*. Comparative biometric calculations showed the ostiolar dimensions of the flax pathogen, *S. petroselini* var. *apii* [*S. apii*] from celery, *S. tritici* from wheat, and *S. gladioli* from gladiolus (mean of 100) to be

32·10, 31·7, 43·7, and 21·25 μ, respectively: these data are considered to furnish further evidence of the identity of *P. linicola* as a *Septoria*.

NEERGAARD (P.). **Nye eller upaaagtede Prydplantesygdomme i Danmark.** [New or unobserved diseases of ornamental plants in Denmark.]—Reprinted from *Gartnertidende, 1938,* 34, 6 pp., 9 figs., 1938. [Received June, 1939.]

Some of the information in this account of eight fungal diseases of ornamental plants new to, or hitherto unobserved in, Denmark has already been noticed from other sources, but the following points are of interest. *Alternaria cheiranthi* [*R.A.M.*, xvi, p. 482] has been prevalent of recent years among wallflower seed stocks. The fungus causes foliar spotting and wilting and may involve the siliquae, whence infection passes to the seed. Another natural host of the organism in Denmark is stock [*Matthiola incana*]. In tests in which sterilized wallflower seeds were grown in soil inoculated with pure cultures of *A. cheiranthi* the percentage of healthy germinating seedlings was reduced from 60·9 to 39·4, the corresponding figure for infection with *Ascochyta cheiranthi* [see above, p. 572] being 42·8. In seed disinfection the best results were given by half-an-hour or an hour's immersion in 0·25 per cent. uspulun, which increased the percentage of germination from 58·3 to 84 per cent., though causing some damage (11 per cent.) to the emerging shoots. The germination and injury percentages for germisan and formalin at the same strength were 81·5 and 8, and 80 and 11·5, respectively.

Ascochyta cheiranthi caused extensive defoliation and produced bluish-grey lesions on wallflower stems in a Copenhagen nursery. In inoculation experiments with pure cultures of the fungus wounded one-month-old plants kept under bell-jars at a relative humidity of 90 to 95 per cent. succumbed more rapidly than those left uncovered (70 to 80 per cent.). The maintenance of relatively dry conditions is therefore an important means of combating infection by *A. cheiranthi*, which probably originates, however, in the seed and should be controlled as recommended above for *Alternaria cheiranthi*.

An undetermined species of *Alternaria* was responsible for heavy losses (estimated at Kr. 1,000 by one grower alone) in *Godetia hybrida*, which developed a dry rot of the stems, followed by wilting and shedding of the leaves. Under humid conditions the diseased organs became covered with a dense, dark green, later sooty, fungal coating. The Sybil Sherwood and Kelvedon Glory varieties were particularly susceptible. Good control was effected by half-an-hour's immersion of the seed in 0·25 per cent. uspulun. Plants to which calcium nitrate was applied early in April contracted infection sooner than those not manured till about 10th May.

LACEY (MARGARET S.). **Studies in bacteriosis. XXIV. Studies on a bacterium associated with leafy galls, fasciations and 'cauliflower' disease of various plants. Part III. Further isolations, inoculation experiments and cultural studies.**—*Ann. appl. Biol.*, xxvi, 2, pp. 262–278, 2 pl., 1939.

The organism causing fasciation of sweet peas [cf. *R.A.M.*, xviii,

p. 317] is referred to in this paper as *Bacterium fascians* [n. comb.], following the rejection of the generic name *Phytomonas* for plant-pathogenic bacteria [ibid., xvii, p. 302]. The author succeeded in isolating this bacterium from plants of 25 different genera belonging to 16 families (both mono- and dicotyledons), genera, species, and even varieties of one family showing considerable differences in susceptibility. Most of these strains, but not all, produced severe fasciation upon inoculation into sweet pea seedlings, and characteristic galls in chrysanthemums, carnations, *Schizanthus retusus, Nicotiana glutinosa, N. tabacum, Heuchera sanguinea, Petunia, Asparagus sprengeri,* peas, beans (*Phaseolus vulgaris*), and broad beans (*Vicia faba*). Inoculations of tomato, gladiolus, and potato gave negative results. Physiological studies failed to demonstrate any cultural differences between the virulent and avirulent strains. Although there was some variation in pathogenicity among the strains, it was not possible from the data to determine any biological distinction. In both naturally and artificially infected plants the galls are invariably produced by the stimulation and abnormal proliferation of bud tissue. Attempts to produce abnormal proliferation of other tissues failed. The bacteria are mainly confined to the exterior of the growths, a thick zoogloea being sometimes found pressed against the outer walls of the epidermis, occasionally penetrating into the intercellular spaces and forming pockets of necrosed tissue. Seeds of *S. retusus* from an infected nursery, when embedded in agar, produced a mixed bacterial growth containing *Bact. fascians,* indicating that the bacterium may be seed-borne.

In further physiological tests the various strains of *Bact. fascians* were separated into two main groups—those producing acid from lactose and those failing to do so, the latter being again separated into those producing a small quantity of acid from mannitol and those causing no increase in the hydrogen-ion concentration of mannitol media. All the strains produced more or less acid from glucose, and saccharose, and coloured litmus milk deep blue, while most of them feebly reduced nitrates when grown on synthetic nitrate agar, but not on fluid synthetic nitrate or peptone media. Liquefaction of gelatine took place on the surface of a stab culture of *Bact. fascians* incubated at 24° C. after two to four weeks.

Brooks (F. T.) & el Alaily (Y. A. S.). **A canker and die-back of Roses caused by Griphosphaeria corticola.**—*Ann. appl. Biol.*, xxvi, 2, pp. 213–226, 2 p., 1939.

A fungus, identified in single spore culture as *Griphosphaeria corticola* (Fckl) v. Höhn, was isolated at Cambridge from dead stems and cankers of various roses. The disease is confined to the stems and appears either as a canker or a die-back. The cankers, which have a smooth and purplish margin, develop as brown depressions in the bark, frequently around some kind of injury, such as pruning wounds, dead buds, leaf scars, wounds made by thorns, and rust lesions, and attain a length varying from half-an-inch to several inches. They either completely girdle the stem or spread downwards, causing die-back in either case. Numerous small, blackish fructifications develop as the bark dies. The optimal temperature for the growth of spores in Dox's medium or on

rose stems was 20° C., while little growth occurred at 5° or 30°, temperatures above 20° favouring, on the other hand, the growth of the aerial mycelium. The conidial fructifications were either acervuli or ill-defined pycnidia and developed before the perithecia. Conidial isolations varied slightly as regards size and shape of spores, cultural behaviour, and relative pathogenicity, but are all referred provisionally to *Coryneum microstictum* [*R.A.M.*, xvii, p. 797]. Perithecia with three-septate, hyaline ascospores were produced after three months in culture, and on rose stems in the field following inoculation with 3 out of 11 isolations. Both the conidia and the ascospores germinated readily, each cell forming a germ-tube, the ascospores occasionally germinating inside the ascus and causing the ascus wall to break down. In inoculation experiments with both ascospores and conidia all the isolations tested proved pathogenic to 16 varieties of roses, Duchess of Atholl, Lady Inchiquin, and Golden Emblem being the most susceptible and Independence Day, Mrs. G. A. Van Rossen, and Madame Edouard Herriot the most resistant. Inoculations were successful at all times except summer, when the invasion of the fungus was stopped by the rapid formation of a gum barrier. The disease may cause considerable damage if allowed to spread without check. With some varieties normal pruning is considered a sufficient means of control, and cutting out and burning of diseased shoots is recommended.

MASSEY (L. M.). **Fungicides for Roses.**—*Amer. Rose Annu., 1939*, pp. 103–111, 1939.

Further tests in 1938 at Cornell University in the control of black spot and mildew of roses (*Diplocarpon rosae* and *Sphaerotheca pannosa*) demonstrated the general superiority of sulphur over copper fungicides. The wettable sulphurs included magnetic, flotation dry (thylox type), and mike [*R.A.M.*, xvii, pp. 256, 722] (4 oz. in 5 gals. water). Effective control was also given by sulphur dust (325 mesh or finer), lime-sulphur (1 in 80), and liver of sulphur (1 oz. in 3 gals.); the soluble sulphurs, however, are more liable than the wettable to injure the bushes. The best of the copper mixtures was 1–½–50 Bordeaux. Under Ithaca conditions severe injury was caused by cuprocide 54, red copper oxide, basic copper sulphate, and copper zeolite, while similar objections apply to the otherwise reasonably satisfactory palustrex sulfonate B and trigen [ibid., xvii, p. 683]. Alphasol OT and OS, Grasselli spreader-sticker, areskap [ibid., xviii, p. 440], bindarene flour, and sodium abietate were effective as spreaders.

GREGORY (P. H.). **The life history of Ramularia vallisumbrosae Cav. on Narcissus.**—*Trans. Brit. mycol. Soc.*, xxiii, 1, pp. 24–54, 1 pl., 33 figs., 1939.

In an account of the life-history of *Ramularia vallisumbrosae* [*R.A.M.*, xvii, p. 42], which he considers to be synonymous with *R. narcissi* and probably also with *Cercosporella narcissi*, the author states that the fungus aestivates by means of sclerotia produced in the epidermal cells of narcissus leaves; in the south-west of England the sclerotia present in old, decaying leaves produce conidia (normally hyaline scolecospores, but phragmospores and amerospores also occur) in January and

February, which serve to infect the new leaves as they appear. On the latter similar conidia are formed from subcuticular sporodochia. The results of cultural studies and inoculation experiments showed that the various forms of conidia from the sporodochia and from the sclerotia all belong to the life-cycle of *R. vallisumbrosae*. Although the fungus by its morphological characters might be classified either as a *Cercosporella* or a *Ramularia*, preference for the present is given to the original name. The sclerotia are considered to be developed from primordia of an as yet undiscovered perithecial stage of the *Mycosphaerella* type; some of their morphological features do not appear to have been previously described for any fungus, such as, for instance, the differentiation of the sclerotium into a sterile fat-storing 'body' and a sporogenous 'neck', in a depression of which the conidiophores originate.

Wenzl (H.). **Die Anfälligkeit der Iris-Arten gegen den Blattdürre-Pilz.** [The susceptibility of Iris species to the leaf spot fungus.]—*Blumen- u. PflBau ver. Gartenwelt*, xliii, 21, p. 246, 1939.

In a large nursery in the Lower Danube valley, Ostmark, where irises were severely attacked by *Heterosporium gracile* [*Didymellina macrospora*: *R.A.M.*, xvii, p. 750] in the summer of 1938, the writer made the following observations on varietal reaction to the leaf spot disease. Not only *Iris germanica* (of which all 30 varieties were infected) but *I. pumila* and the hybrid *I. interregna* (*I. germanica* × *I. pumila*)—Helge, Halfdan, and Valhalla varieties—proved more or less susceptible. Six varieties of *I. kaempferi*, *I. ochroleuca*, and *I. sibirica* were immune, and no spotting was observed on *I. forrestii* and *I. transsilvanica*.

Preti (G.). **Moria di piante di 'Cereus peruvianus monstruosus' per 'fusariosi' in Provincia di Imperia.** [Wilt of *Cereus peruvianus monstruosus* plants due to fusariosis in the Province of Imperia.]—*Riv. Pat. veg.*, xxix, 3–4, pp. 169–183, 6 figs., 1939.

In August, 1938, young *Cereus peruvianus monstruosus* plants in hotbeds under glass near San Remo nearly all rapidly wilted and died as a result of infection by *Fusarium oxysporum* [*R.A.M.*, xiii, p. 639], which causes a soft, black rot beginning at the top of the plants and progressing downwards. Inoculations of healthy plants gave positive results when the inoculum was inserted in small, deep wounds, but not when the surface of the wounds was large and exposed to the air. Conidial germination occurred at temperatures ranging from 21° to 30° C., but was much impaired in darkness.

Klinkowski (M.). **Beobachtungen über Krankheiten und Schädlinge iberischer Wildformen von Serradella und Lupine.** [Observations on diseases and pests of Iberian wild forms of Serradella and Lupin.]—*Z. PflKrankh.*, xlix, 5, pp. 305–321, 12 figs., 1 map, 1939.

During a tour of Spanish Morocco, south Spain, and Portugal in 1937 the writer observed severe mildew (*Erysiphe pisi*) [*E. polygoni*] infection on wild yellow lupins (*Lupinus luteus*) [*R.A.M.*, xv, p. 100]

in the vicinity of Algeciras (Spain), whereas in south Portugal, where climatic conditions similarly favourable to the disease obtain, a resistant strain of the host plant is established. Rust (*Uromyces renovatus*) [ibid., xviii, pp. 116, 549] occurred on *L. luteus*, *L. angustifolius*, *L. hirsutus*, *L. albus*, and *L. rothmaleri* in Portugal and on *L. hirsutus* and *L. angustifolius* in Spain.

FUKUSHI (T.). **The relation of aphids to the transmission of legume mosaics (2).**—*J. Sapporo Soc. Agric. For.*, xxx, 147, pp. 399–418, 1939. [Japanese, with English summary.]

Red clover [*Trifolium pratense*] mosaic was found to be readily transmissible by means of *Aphis laburni* to peas, broad beans [*Vicia faba*], beans [*Phaseolus vulgaris*], and crimson and alsike clovers [*T. incarnatum* and *T. hybridum*: *R.A.M.*, xvii, p. 575]. With the exception of *P. vulgaris*, on which the symptoms produced were somewhat different from those of bean mosaic, the experimental plants reacted to inoculation by the development of symptoms similar to those observed in the field. The aphids frequently acquired the virus during a feeding period of five to ten minutes on diseased red clover, and individuals carrying the virus were sometimes able to infect peas in five-minute exposures. Viruliferous aphids lost their infective capacity after feeding on healthy peas for 10 to 30 minutes, but retained it for about an hour when deprived of food after removal from diseased plants; subsequently infectivity gradually declined. *A. laburni* is present in abundance on broad beans in most districts of Honshu and multiplies profusely on clovers under cages and in the greenhouse, though these plants are not yet definitely known to serve as natural hosts of the insect. Under local conditions, therefore, primary outbreaks and the subsequent dissemination of broad bean mosaic are probably brought about largely by *A. laburni*, which appears, on the other hand, to be absent from Hokkaido, where the disease is a rarity.

Macrosiphum matsumuraeanum and *Acyrthosiphon kondoi* both occur on clovers in Hokkaido. In inoculation experiments the former transmitted red clover mosaic to its own host, white clover [*T. repens*], *T. hybridum*, and peas, while the latter conveyed the virus to peas, *P. vulgaris*, and *T. incarnatum* in a small percentage of cases.

Pending comparative physico-chemical investigations it cannot be definitely decided whether the red clover, pea, and broad bean mosaic diseases are attributable to a single virus, but the balance of available evidence is considered to point in this direction. The Japanese virus resembles a number of other legume mosaic viruses, particularly that of Osborn's pea mosaic (pea virus 2) [ibid., xvii, pp. 126, 249].

KOMAROVA (Mme A.). О вредоносности Клеверного антракноза. [On the injuriousness of Clover anthracnose].—*Pl. Prot., Leningr.*, *1939*, 18, pp. 166–169, 1939.

The fungus *Gloeosporium caulivorum* [*Kabatiella caulivora*: *R.A.M.*, xvii, p. 441] is stated to attack overwintered two- and three-year-old clover plants more intensely than one-year-old, and cultivated varieties more than wild ones. For instance, data collected in 1929 show that none of the 106 samples of wild and 92 of cultivated clover were

attacked in the first year of growth, whereas in the second year 85·4 and 10·9 per cent. of the cultivated and 57·1 and 14·3 per cent. of the wild clover were affected slightly and moderately severely, respectively. The early ripening varieties Kieffsky, Souttonovsky 3942, and Nossovsky were less affected by the disease than the late ripening ones, and in their third year of growth showed a decrease both in the amount and degree of infection, while it increased in the late ripening varieties. The disease appears in overwintered clover in June and reaches its maximum development in August.

The destructiveness of the disease was studied in relation to the degree of infection. No plants showing no infection (O) or slight infection (I) were found, the others were divided among categories II (up to five weak spots on the stems), III (up to three sunken spots on the stems), IV (up to five sunken spots on the stems), and V (canker causing stem break). Assuming the yield and the absolute weight of seeds (1,000) in category II to be 100 in each case, the corresponding figures in III were 74 and 96; in IV, 70 and 90; and in V, 35 and 88, respectively. The disease develops more intensely in warm than in rainy years. The best results in disinfection tests were obtained with dry heat treatment of the seeds, either for six hours at 70° or four days at 60° C., which increased the germination of the seeds and reduced infection to innocuous proportions.

NEILL (J. C.) & HYDE (E. O. C.). **Blind-seed disease of Rye-Grass.**—*N.Z.J. Sci. Tech.*, xx A, 5, pp. 281–301, 18 figs., 1939.

The condition of low germinability of perennial rye grass (*Lolium perenne*) seed [*R.A.M.*, xviii, p. 186], found throughout New Zealand and also in samples from England, Scotland, Wales, Ireland, Sweden, Tasmania, and Victoria, is named 'blind-seed disease' and attributed to a fungus tentatively placed in the genus *Helotium* and apparently allied to *H. herbarum.* Infected seed may resemble healthy seed in appearance, but is thin and shrunken when infected early. Fungal hyphae may be found in the endosperm and embryonic tissues but not in the aleurone layer or seed coat. Conidia are always present. After exposure to cool, moist conditions such as obtain in soil during winter, 'blind' seeds may develop small, pink, waxy, irregularly coremiform sporodochia, 0·5 to 1 mm. by 0·4 to 0·6 mm., composed of a central core of compacted conidiophores, diverging apically to form penicillate branches bearing sterigmata, 6 to 9 by 2·5 μ, and continuous, smooth, hyaline, broadly elliptical microconidia, 2·3 to 2·8 by 1·8 to 2·3 μ, embedded in a gelatinous matrix. Attempts to induce germination of the microconidia failed. With the first flowering of the rye grass the 'blind' seeds bear apothecia which shrivel in a few hours if exposed to direct sunshine or a dry atmosphere. The apothecia have light pinkish brown, later cinnamon brown, disks, smooth at first, cupulate, later saucer-shaped to flat, and white smooth stipes, which internally are pinkish brown. The asci are cylindrical-clavate, 70 to 80 by 4·5 to 5 μ, normally 75 by 5 μ, eight-spored, the apical plug not staining blue with iodine; the paraphyses are colourless, septate, filiform, without swollen apices, 1·5 to 2 μ in diameter. The ascospores are uniseriate, continuous, hyaline, smooth, elliptical, with somewhat pointed ends,

7 to 8 by 3 to 4 μ, generally showing two polar refractive globules. When discharged from the apothecia the ascospores lodge upon the open florets and infect the young seed, but the precise manner in which this is done has not been determined. Once established the fungus produces great numbers of macroconidia of the *Pullularia* type [loc. cit.] which surround the ovary as a pinkish, slimy mass, filling the space between the glumes. In culture they are borne on submerged or surface hyphae, and are smooth, hyaline, cylindrical to allantoid, with hemispherical ends, 12 to 19 by 3 to 3·5 μ, normally 17 by 3·5 μ, with a thick semi-gelatinous epispore; they arise laterally on a hyphal cell or, more normally, from the apex of a sterigmatic process, 7 to 8 by 2 μ. In flask cultures the fungus produced apothecia on from 1 to 15 per cent. of the number of seeds sown, development being hastened by warmth after planting.

Typical symptoms of blind-seed disease have been produced on *Lolium perenne* by immersing the spikes in suspensions of ascospores from crushed apothecia, of macroconidia from either single ascospore cultures, pure cultures, or single-spore isolations, and in mass suspensions of the conidial slime on *Lolium* ovaries. Four other fungi belonging to the Helotiaceae were collected on or near *Lolium* plants; and one is described under the name *Lolium* fungus No. 2, but inoculations with pure cultures were unsuccessful. Isolations from 100 'blind' seeds harvested in January and cultured in March to April were successful in nearly every case, but attempts to isolate the fungus from a further 100 seeds in October yielded the fungus only twice. In certain cases the fungus was able to survive and to produce apothecia after 20 months' storage in the laboratory.

Field evidence seems to indicate that Italian rye grass (*L. multiflorum*) is almost immune from the disease, the true perennial highly susceptible, and the intermediate 'false perennial' strains intermediate in susceptibility. The apparent resistance of the Italian types may result from their late flowering, which occurs after the main discharge of ascospores. The most hopeful method of controlling the disease is believed to lie in the selection or breeding of resistant strains. There is no evidence that the disease has any deleterious effect on rye grass not used for seed production.

KESSLER (W.). **Über den Einfluss von Schwefelkalkbleiarsen und anderen Pflanzenschutzmitteln auf den Chlorophyllgehalt des Apfellaubes.** [On the influence of lime-sulphur–lead arsenate and other plant protectives on the chlorophyll content of Apple foliage.] —*Gartenbauwiss.*, xiii, 2, pp. 154–168, 1 fig., 1939.

In the course of the systematic spraying experiments for the control of apple scab (*Fusicladium*) [*Venturia inaequalis*] in progress in the orchards of the Lower Elbe Valley, North Germany [*R.A.M.*, xviii, p. 531], a mixture of 2 per cent. lime-sulphur and 1 per cent. lead arsenate paste has been observed for some years past to induce a very luxuriant growth of dark green foliage, which not only attracts the woolly aphis [*Eriosoma lanigerum*] but also impairs the appearance and keeping quality of the fruit. In 1938 a similar effect was produced in large-scale tests by a stimulatory polysulphide preparation (1·5 per

cent.) submitted on trial to the Jork Experimental Station. On the other hand, Ob 72 (pomarsol) [ibid., xvii, p. 626], used throughout as a control, caused no alteration in the normal habit of foliar development.

The phenomenon was found to be due to a substantial increase (10 to 30 per cent.) in the chlorophyll content per unit of leaf mass, a similar but appreciably stronger action, resulting in a 30 to 100 per cent. rise in the chlorophyll content, being exerted by heavy applications of nitrogen (90 kg. per hect. in the form of nitrophoska) on Nathusius' Taubenapfel and Jakob Lebel. The unnamed polysulphide stimulant being entirely free from arsenic, it is evident that this element cannot be concerned in the foliar changes under discussion, which are thought more probably to be associated with the structure of the deposit.

LOPATIN (M. I.). Влияние бактерияльного корневого рака (зобоватости) на дальнейшее развитие Вишни в плодовом саду. [Influence of bacterial root canker (crown gall) on the development of the Cherry tree in the orchard.]—*Pl. Prot., Leningr., 1939*, 18, pp. 169–173, 1939.

In field experiments with crown gall [*Bacterium tumefaciens*] on cherry, analyses of the development of Lotovka trees under conditions of drought lasting throughout the summer were made three and six months after planting. The control trees with healthy roots suffered least from the drought (16 per cent. almost or entirely perished) and showed the best new growth (average of 82·9 cm. per tree); trees with galls on lateral roots only, those with galls on root bases, and those with galls on root collars were more severely affected in this order, and those with galls on root bases and on lateral roots suffered most (60 per cent. almost or entirely perished) and showed the least new growth (average of 31·4 cm. per tree).

ELSSMANN (E.). **Prüfung von Sauerkirschensorten auf ihr Verhalten gegen Sclerotinia cinerea Schroet.** [Trials of sour Cherry varieties for their reaction to *Sclerotinia cinerea* Schroet.]—*Forschungsdienst*, vii, 4, pp. 361–366, 3 figs., 1939.

Of the 17 sour cherry varieties tested in 1938 at Weihenstephan (Bavaria) Horticultural Institute for their reaction to *Sclerotinia cinerea* [*S. laxa*: *R.A.M.*, xvii, p. 687; xviii, p. 508], only Montmorency Stark proved entirely immune, while a number of others, including Grosser Gobet, Diemitzer Amarelle, Ostheimer Weichsel, Drandsdorfer Saure, Hindenburg, Leitzkauer Pressauer, and Frühe Ludwig, developed gummosis but no wilting. The two types of reaction were quite distinct, severe wilting never being accompanied by gummosis or vice versa.

HUBER (G. A.) & BAUR (K.). **The use of calcium cyanamid for the destruction of apothecia of Sclerotinia fructicola.**—*Phytopathology*, xxix, 5, pp. 436–441, 1 fig., 1 graph, 1939.

In tests conducted in April, 1938, at the Western Washington Experiment Station, commercial pulverized and oiled calcium cyanamide, applied with a knapsack duster to the surface of the soil and vegetative cover of peas and chickweed (*Stellaria media*) under prune trees at the rate of 220 lb. per acre at the outset of apothecial produc-

tion, destroyed the existing apothecia of *Sclerotinia fructicola* [*R.A.M.*, xviii, pp. 534, 535] and prevented the development of others. Comparable results were obtained when soil in wooden boxes, in which apothecia were maturing, was treated with a surface application of the same compound at the rate of 324 lb. per acre.

HOPKINS (J. C. F.). **Three important Strawberry diseases.**—*Rhod. agric. J.*, xxxvi, 4, pp. 254–259, 1 pl., 1939.

The serious deterioration of strawberry crops in Southern Rhodesia is ascribed to attacks of mildew (*Sphaerotheca humuli*) [*R.A.M.* xviii, p. 402] and two virus diseases identified in the last two years as 'yellow edge' [ibid., xviii, p. 326] and 'severe crinkle' [loc. cit.]. The degeneration of the famous Vumba variety, producing at present only small, sour, poorly flavoured fruit, is attributed chiefly to these virus diseases. Most varieties grown in the colony are stated to be susceptible to mildew. The two virus diseases are frequently found in association and are both systemic. They are widely distributed in Southern Rhodesia and are possibly spread by an aphid at present under investigation. For the control of these diseases it is recommended to plant only resistant varieties and to rogue diseased plants at the end of each season, while the application of sulphur sprays containing nicotine sulphate (40 per cent.) is advocated as a precautionary measure against the possible vector.

NANNIZZI (A.). **Sullo svernamento della Cercospora cladosporioides Sacc.** [On the overwintering of *Cercospora cladosporioides* Sacc.]—*Atti Sez. agric. Accad. Fisiocr. Siena*, v, pp. 168–170, 1938. [Abs. in *Riv. Pat. veg.*, xxix, 3–4, p. 201, 1939.]

Cercospora cladosporioides [*R.A.M.*, x, p. 130] is stated to have become progressively more prevalent in olive groves in the vicinity of Siena. When the infected leaves fall in autumn, the mycelial stromata that fill the substomatal cavities thicken and extrude as small bodies resembling perithecia, on the surface of which conidia develop at the end of winter, and infect the leaves of the small sterile branches that fruited in the previous year.

[GREGORY (G. B.).] **Report on the Department of Agriculture, St. Lucia, 1937.**—43 pp., 1 graph, 1939.

During 1937, 319,633 banana plants were inspected in St. Lucia, of which 7,894 (or 2·47 per cent.) were found to be infected with Panama disease [*Fusarium oxysporum cubense*] and were destroyed [cf. *R.A.M.*, xvi, p. 20]. While the percentage of infection was much higher than in 1936, when it was only 0·89 per cent., many areas hitherto regarded as abandoned and not previously examined were on this occasion brought into the survey.

EHRKE [G.]. **Regelvorrichtung für das selbsttätige Zuteilen von Beizpulver beim Röberschen Trockenbeizer. (System Dr. Stümpfig.)** [A regulating device for the automatic distribution of dust in the Röber dusting apparatus. (Dr. Stümpfig's system.)]—*Masch.- u. Geräteprüf. Reichsnährst.* (Suppl. to *Tech. in d. Landw.*), iv, 4, pp. 27–28, 1 fig., 1939.

Details are given of the construction and use of a special contrivance

for regulating the distribution of the dust in the continuous dusting apparatus supplied by Gebr. Röber, G.m.b.H., Wutha, Thüringen [cf. *R.A.M.*, xviii, p. 466]. Its treating capacity is 800 kg. of seed-grain per hour, and the cost is RM. 55.

POLYAKOFF (I. M.) & PETROVA (Mme A. P.). Изыскание новых протравителей с целью замены формалина. [Investigation on new fungicides to replace formalin.]—*Pl. Prot., Leningr., 1939*, 18, pp. 121–129, 1939.

In laboratory tests a new liquid disinfectant called condensat, a by-product of synthetic rubber and containing 10 per cent. aldehydes (including 9·1 per cent. formaldehyde) and 4 per cent. organic acids, gave complete control of wheat bunt [*Tilletia caries*], covered smut of barley [*Ustilago hordei*], and loose smut of oats [*U. avenae*]. The new disinfectant proved to be potentially more toxic to the fungi than formalin, possibly due to the presence of other aldehydes and organic acids. In conclusion solutions of condensat 3·33 in 300 and 3·33 in 80 used in the wet and the semi-dry methods of disinfection, respectively, are recommended as effective in controlling the three diseases without reducing the germination of the seed-grain.

ANDRÉN (F.). **Kontroll av bekämpningsmedel mot parasitsvampar.** [The testing of disinfectants against parasitic fungi.]—*Nord. JordbrForskn.*, 1938, 4–7, pp. 475–481, 1938.

Details are given of the methods employed in Sweden in the official testing of plant protectives in their various forms, e.g., as steeping solutions for cereal seed-grain and as sprays or dusts for the control of potato blight [*Phytophthora infestans*] and apple scab [*Venturia inaequalis*]. In the case of the last-named, the tests usually involve two or three varieties in the same number of orchards, five trees of each variety being treated with each of the different preparations. The potato plots are treated two or three times in three to five replications, using 2 per cent. Bordeaux mixture as a control.

DOERR (R.) & HALLAUER (C.). **Handbuch der Virusforschung. Erste Hälfte.** [A handbook of virus research. First half.]—xii+546 pp., 35 figs. (10 col.), 23 diags., 13 graphs, Vienna, J. Springer, 1938. RM. 66 (bound RM. 69). Foreign: less 25 per cent. discount. [Received July, 1939.]

The first volume of this exhaustive compilation on virus diseases comprises, among others, sections on the development of virus research and the problems confronting workers in this field by R. Doerr; a useful summary of methods of determining particle size by W. S. Elford; an interesting application of the fluorescence microscope by M. Haitinger; and a summary of the biochemistry and biophysics of viruses by W. M. Stanley. Each section is followed by a comprehensive bibliography of the pertinent literature, most of the papers of phytopathological interest included in which have been noticed from time to time in this *Review*.

McFarlane (A. S.). **Chemistry of the plant viruses.**—*Biol. Rev.*, xiv, 2, pp. 223–242, 6 figs., 2 graphs, 1939.

The writer summarizes and briefly discusses some of the most outstanding recent contributions to the chemistry of the plant viruses [most of which have been noticed from time to time in this *Review*] under the headings of preparation, elementary composition, sedimentation behaviour, P_H stability, electrophoretic behaviour, anisotropy of the plant viruses, virus 'crystals' and 'gels', molecular dimensions, and some general properties.

Best (R. J.). **Virus activity as a property of some protein molecules.**—*J. Aust. Inst. agric. Sci.*, v, 2, pp. 94–102, 2 figs., 3 graphs, 1939.

This is a summary of the author's contribution to a symposium on 'The Relation between Chemical Constitution and Biological Activity' at the meeting of the Australian and New Zealand Association for the Advancement of Science, Canberra, January, 1939. The evidence for the protein nature of the mosaic group of viruses is regarded as so overwhelming that in any future discussion of the subject the onus of proof rests on those maintaining the contrary opinion. Divergences in molecular structure may be due partly to different prosthetic groups of the virus molecule and partly to different arrangements and proportions of the common constituents. The common property of self-multiplication may probably be explained by some common factor, very likely the general pattern of the protein molecule, slightly different arrangements within which would give rise to distinct virus types. With regard to the mechanism of multiplication, the molecule may be regarded as a sort of template, the electronic forces of which would attract to its surface from the environment the essential building blocks for its continuous reconstruction in the form of exactly similar elements.

[A condensed report of the paper is also given in *Aust. J. Sci.*, i, 5, pp. 159–160, 1939, which further summarizes the contributions to the symposium of B. T. Dickson, J. G. Bald, F. M. Burnet, and others (pp. 145–148).]

Bennett (C. W.). **The nomenclature of plant viruses.**—*Phytopathology*, xxix, 5, pp. 422–430, 1939.

Discussing the complex problem of the nomenclature of plant viruses, the writer raises a number of objections to the present system of numbering. The very facility of the method tends to encourage frequent changes and the arbitrary application of numbers to inadequately characterized viruses. Numbers, moreover, convey no meaning in respect of any particular feature of the viruses they purport to designate, and are therefore difficult to remember in connexion with a given disease. A further disadvantage of numbers is that they do not give sufficient scope for the organization of viruses according to different concepts of relationship; the name *Beta* virus 1, for instance, has been applied to two possibly distinct viruses, one of which may have to be renamed *Beta* virus 6, the intervening numbers having been assigned to other diseases. These and other difficulties could be solved by the

substitution for numbers of names descriptive of important properties of the virus under consideration: tobacco virus 1, for example, might be named tobacco (or *Nicotiana*) *virus altathermus*. Should subsequent investigators demonstrate the organic nature of viruses, the same virus might be known as *Paracrystalis altathermus*: if, on the other hand, they are proved to be chemical compounds, the suffix 'vir' might be adopted to signify a virus, in the same way as the termination 'ase' designates enzymes. In this case tobacco virus would become 'altathermovir'.

HOLMES (F. O.). **Proposal for extension of the binomial system of nomenclature to include viruses.**—*Phytopathology*, xxix, 5, pp. 431–436, 1939.

A scheme is propounded for the extension to viruses of the binomial system of nomenclature, under which a number of well-known plant diseases would be grouped in various families of class II (Spermatophytophagi) of Division I (Phytophagi) of the virus kingdom. Thus, family 1 (Chlorogenaceae) comprises the yellow viruses; 2 (Marmoraceae) the various types of mosaic; 3 (Annulaceae) the ring spots; 4 (Gallaceae) is represented only by *Galla fijiensis*, the agent of Fiji disease [of sugar-cane]; 5 (Acrogenaceae) by potato spindle tuber; and 6 (Rugaceae) by the leaf curl group. Class I (Schizophytophagi) of Division I comprises only one family, the Phagaceae (bacteriophages). Division II (Zoophagi) embraces two families, the Arthropodophagi and the Chordatophagi.

AINSWORTH (G. C.). **The nomenclature of plant viruses.**—*Chron. bot.*, v, 2–3, pp. 193–194, 1939.

The author expresses the opinion that although the practice of distinguishing viruses by numbers coupled with the names of the principal host plants has been widely accepted, it would prove very difficult to obtain international conformity to any detailed list of viruses which attempted to include all 'strains'. He considers it to be desirable that the International Committee on Description and Nomenclature of Plant Viruses should publish a list of virus types, and indicate a method (which could be applied by individual authors) for naming 'strains'. It is suggested that a convenient method of distinguishing 'strains' would be the addition in roman type to the type name in italics of either any particular designation given by the author who described the variant, or a name derived from the name of the disease, with the name of the author and the date. Thus, if the type tobacco mosaic virus was designated *Nicotiana tabacum virus* I strains could be distinguished as follows: *Nicotiana tabacum virus* I, masked strain, Holmes, 1934; *N. t. virus* I, tobacco virus 6, J. Johnson, 1927.

YU (T. F.). **A list of plant viroses observed in China.**—*Phytopathology*, xxix, 5, pp. 459–461, 1939.

A list is given of the plant virus diseases observed in the course of phytopathological surveys made in China during the period from 1932 to 1937 [cf. *R.A.M.*, xv, p. 385]. In addition to those already reported in this *Review*, the following items may be mentioned: mosaic of lucerne,

cabbage, celery, *Primula sinensis*, clovers (*Trifolium pratense* and *T. repens*), cowpea (5 to 12 per cent.), *Dahlia* [ibid., xvii, pp. 114, 443, 684], *Datura metel*, hyacinth bean (*Dolichos lablab*), lettuce, nasturtium (*Tropaeolum majus*), peas, groundnuts, *Petunia violacea* [ibid., xviii, p. 458], vegetable marrow, radish, rape, raspberry, soy-bean (up to 100 per cent. in Shantung) [ibid., xvii, p. 655], spinach, and sweet clover (*Melilotus alba*); broad bean rosette, a hitherto undescribed disease prevalent in and near Nanking, where it may reduce the plants to tufts of small, chlorotic, curled, distorted leaves and involve losses of 5 to 50 per cent.; potato leaf roll (general in Kiangsu, 5 to 31 per cent.), spindle tuber, and witches' broom, and streak [ibid., xviii, p. 464], leaf curl, leaf roll, and rugose mosaic of tomato.

LINDQUIST (B.). **Die Fichtenmykorrhiza im Lichte der modernen Wuchsstoffforschung.** [Spruce mycorrhiza in the light of modern growth substance research.]—*Bot. Notiser*, *1939*, 2, pp. 314–355, 7 figs., 4 graphs, 1939.

A fully detailed, tabulated account is given of the writer's experiments (1934 to 1937) at Lund, Sweden, on the effect of extracts from pure cultures of mycorrhiza-forming and other soil fungi on spruce seedlings grown in Erlenmeyer flasks on sand with the addition of a synthetic solution [*R.A.M.*, xviii, p. 542]. A definite stimulus to development was afforded only by the secretions of the unnamed hyaline mycelium 82 e, composed of sparsely branched, regularly septate hyphae, 3 to 4 μ in diameter, isolated from ectotrophic mycorrhiza in a spruce stand in Ångermanland; by that of *Mycelium radicis nigrostrigosum* [ibid., xv, p. 308], which tends to become parasitic on heavily shaded test plants; and by that of mycelium 19 f, isolated from spruce roots in Ångermanland and apparently distributed throughout Sweden, which acts both as a parasite and mycorrhiza-former. Mycelium 19 f is characterized on malt agar by a fairly abundant, hyaline, branched cotton wool-like mycelium, the irregularly septate hyphae of which measure 2 to 3 μ in diameter and show a marked tendency to anastomosis and oidial formation, and by a remarkable degree of resistance to cold, growth continuing at 0·5° C. (optimum P_H 5). The growth of the seedlings was retarded by the secretions of the parasitic soil fungi *M. r. atrovirens* (widespread in Scandinavian forests) [ibid., xii, p. 386], a Danish strain of *Mucor ramannianus* [ibid., xvi, p. 710; xviii, pp. 137, 232] (also prevalent in Sweden), and mycelium 17 a (from beech roots in Denmark, general throughout Scandinavia), characterized by a luxuriant, white, woolly mycelium consisting of hyaline, septate, irregularly branched hyphae, 1·5 to 3 μ, with numerous cords, coils, and clamp-connexions; the last-named fungus, in research work on symbiosis, exerted the most destructive action yet observed by the writer. Mycelium 52 c, characterized by slender, greyish-black to hyaline, profusely branched, irregularly septate hyphae, isolated from abnormal spherical mycorrhiza on beech roots in Denmark, had no effect on the seedlings, neither expediting nor delaying their growth.

The paper concludes with a critical discussion of the various theories advanced in explanation of the mycorrhizal phenomenon, including those of nitrogen and mineral salt nutrition of Frank (*Forstwiss. Zbl.*,

xvi, 1894) and Stahl (*Jb. wiss. Bot.*, xxxiv, 1900), respectively, and the growth substance interaction theory which is now being actively debated in the relevant literature.

Foster (J. W.). **The heavy metal nutrition of fungi.**—*Bot. Rev.*, v, 4, pp. 207–239, 1939.

A critical review, followed by a bibliography of 152 titles, is given of important contributions to the study of the effects on fungal growth (with special reference to *Aspergillus niger* and related Hyphomycetes) of nutrition with the heavy metals (chiefly zinc, iron, copper, and manganese) [*R.A.M.*, xvi, p. 199; xviii, pp. 240, 336].

Harter (L. L.). **Influence of light on the length of the conidia in certain species of Fusarium.**—*Amer. J. Bot.*, xxvi, 4, pp. 234–243, 1939.

With reference to the considerable difficulties which present themselves in identifying species of *Fusarium*, the author advocates the standardization of cultural methods. The special subject of this study is the influence of solar and artificial light on the length of the triseptate conidia of *F. coeruleum* [*R.A.M.*, xviii, p. 409], *F. martii* var. *pisi* [*F. solani* var. *martii* f. 2: ibid., xvi, p. 439], and *F. bulbigenum* var. *batatas* [ibid., xviii, p. 496], grown under otherwise identical conditions. The conidia reached their greatest length in cultures exposed to the maximum of available daylight, followed by those in cultures exposed to sunlight for three hours daily, while the shortest were produced in the dark, irrespective of the medium. The mean lengths of the conidia of *F. bulbigenum* var. *batatas* grown on the same medium in the light and in the dark were 38·7 and 31·6 μ, respectively, and of *F. coeruleum* 42 and 30·9 μ, respectively, these variations being much greater than the range hitherto accepted as separating certain species. A similar increase in the mean length of conidia of all three species was obtained with artificial illumination. Cultures kept in the dark during the first two days after inoculation and then irradiated differed little in spore length from cultures irradiated from the beginning; cultures kept in the dark during the first four days and then irradiated produced spores of the same length as those kept in the dark for the whole period of growth, while cultures exposed to light during the first four days and then placed in the dark produced spores of the same length as those exposed to light for the entire period of growth. The mycelial growth was more abundant in cultures kept in the dark, but sporodochia and pionnotes were more copious in the light. Macroconidia were more numerous in the light and microconidia in the dark. Statistically significant differences occurred in the conidial measurements of nine different investigators working with the same microscopical preparation.

D'Aeth (H. R. X.). **A survey of interaction between fungi.**—*Biol. Rev.*, xiv, 2, pp. 105–131, 1939.

The 'dispersed and fragmentary' literature dealing with the complex problems of fungal interaction [most of which has been noticed from time to time in this *Review*] is here assembled and concisely discussed. The bibliography comprises 175 titles.

HEINTZELER (IRENE). **Das Wachstum der Schimmelpilze in Abhängigkeit von den Hydraturverhältnissen unter verschiedenen Außenbedingungen.** [The growth of moulds in relation to atmospheric humidity under varying external conditions.]—*Arch. Mikrobiol.*, x, 1, pp. 92–132, 5 figs., 13 graphs, 1939.

A comprehensive survey is given of the writer's studies at the Stuttgart (Germany) Technical College to ascertain the humidity relationships of three groups of fungi, viz., (1) xerophile, with a germination limit under 80 per cent. relative humidity; (2) mesophile (between 80 and 90 per cent.); and (3) hygrophile (over 90 per cent.). Group (1) comprises *Aspergillus glaucus*, *A. niger*, and *Penicillium glaucum*; (2) *Sporodinia grandis*, *Rhizopus nigricans*, *Phycomyces nitens*, and *Ustilago avenae*; an intermediate position between (2) and (3) was occupied by *Oidium* [*Oospora*] *lactis* [*R.A.M.*, xvii, p. 530]. The organisms were grown on Koch's malt gelatine (except *O. lactis*, for which yeast water gelatine was used).

The optimum relative humidities for the growth of *A. niger* and *A. glaucus* in a steam-saturated atmosphere were 98 and 93 per cent., respectively. The optimum temperature for *A. glaucus* was found to be about 30° C., while 20° was more favourable to *P. glaucum*, *R. nigricans*, *Phycomyces nitens*, and *O. lactis*.

The absolute minimum for normal growth and reproduction was found to be 73·3 per cent. relative humidity (*A. glaucus*), the corresponding values for *A. niger*, *Penicillium glaucum*, *S. grandis*, *R. nigricans*, *Phycomyces nitens*, *U. avenae*, and *O. lactis* being 79, 77·8, 83·3, 84·1, 86, 87·8, and 89·8, respectively.

In salt solutions the vapour pressure limits were higher than those obtained on a solid medium (12 per cent. in calcium chloride and 6 per cent. in sodium chloride, potassium chloride, and a 'balanced' solution containing, in addition to the foregoing, magnesium chloride and magnesium sulphate).

DIEHL (R.). **La Pomme de Terre. Caractères et description des variétés.** [The Potato. Characters and description of the varieties.]—157 pp., 65 col. pl., 12 figs., 1 graph, Paris, Imprimerie Nationale, 1938. 60 fr.

In this useful work the author devotes a chapter to varietal reaction to the principal potato diseases. The degree of resistance to the chief diseases is also indicated for each of the 96 varieties described.

MANIL (P.). **À propos d'une nouvelle méthode d'examen des tubercules de Pomme de terre, en vue du diagnostic de viroses.** [On a new method of examination of Potato tubers from the standpoint of virus diagnoses.]—*C.R. Soc. Biol., Paris*, cxxx, 1, pp. 80–84, 1939.

The results obtained by the writer in the application of Friedrich's Biuret method to the diagnosis of potato viruses [*R.A.M.*, xvii, p. 763] were conflicting, the most consistent data being given by local (Gembloux, Belgium) material of Industrie affected by generalized leaf roll. The observations on the same variety suffering from mosaic (A) and streak (Y) were contradictory. These discrepancies, however, need not

necessarily detract from the value of the method, more especially as the author's approach to the virus problem is somewhat different from Friedrich's, the former being more concerned with the 'clinical' and the latter with the physiological aspects of the disorders.

Philipp (W.). **Anfälligkeit der Kartoffelsorten für Eisenfleckigkeit.** [Varietal susceptibility of Potatoes to 'Eisenfleckigkeit'.]—*Kranke Pflanze*, xvi, 4, pp. 69–71, 1939.

Lists are given of (*a*) culinary and (*b*) industrial potato varieties grouped according to their reactions to 'Eisenfleckigkeit' [*R.A.M.*, xviii, p. 476]. Category (*a*) comprises ten practically immune varieties (Frühbote, Mittelfrühe, Edelgard, Voran, Konsuragis, Preussen, Havilla, Venus, Feldglück, and Edelragis); twelve slightly susceptible (Frühmölle, Juli, Aal, Allerfrüheste Gelbe, Zwickauer Frühe, Weltwunder, Priska, Sabina, Ostbote, Industrie, Bardengold, and Goldgelbe); seven fairly susceptible (Erstling [Duke of York], Sieglinde, Flava, Ovalgelbe, Ackersegen, Edda, and Altgold); and ten highly susceptible (Früheste Delikatess, Frühgold, Krebsfeste Kaiserkrone, Dir. Johannsen, Lichtblick, Alpha, Erdgold, Goldwährung, Treff As, and Jubel). There are no semi-immune varieties in group (*b*) but nine slightly susceptible, including Stärkereiche [Starchy] I and Wekaragis, and 15 moderately to highly susceptible, among which are Stärkeragis, Centifolia, Wohltmann, Pepo, and Sickingen.

Beregovoy (P.). К вопросу изучения устойчивости сортов Картофеля против порошистой парши. [A contribution to the study of varietal resistance of Potato to powdery scab.]—*Pl. Prot., Leningr., 1939*, 18, pp. 163–165, 1939.

None of the eight potato varieties tested by the Kieff Quarantine Laboratory showed complete resistance to *Spongospora subterranea* [*R.A.M.*, xviii, p. 379], although the degree of infection was generally low. The highest degree of resistance was exhibited by Wohltmann (12·1 per cent. infection) which is recommended for cultivation on sandy or sub-sandy soils, where with the help of fertilizers and good cultivation it is known to give high yields. No correlation was found between infection with *S. subterranea* and common scab [*Actinomyces scabies*] or *Rhizoctonia* disease [*Corticium solani*], but infection with *Phytophthora* [*infestans*] was found to increase *pari passu* with *S. subterranea* infection. Thus the amount of *Phytophthora* infection in potatoes free from, or showing a low, slightly higher, and high degree of *S. subterranea* infection was 2, 4, 7·5, and 12·2 per cent., respectively.

Cunningham (H. S.) & Wessels (P. H.). **Controlling common scab of the Potato on Long Island by the addition of mercury compounds to the fertilizer mixture and the relation of soil reaction to the treatment.**—*Bull. N.Y. St. agric. Exp. Sta.* 685, 20 pp., 1939.

In experiments carried out on Long Island from 1934 to 1937 Irish Cobbler and Green Mountain potatoes were grown in soil dressed with fertilizer mixture (5–8–5, apparently neutral) containing yellow oxide of mercury or calomel [mercurous chloride] at the rate of 2, 4, and 6 lb.

per ton, and applied at the rate of 1 ton per acre. In 1938 the same area was planted and dressed with fertilizer, but the mercury was omitted.

The data obtained [which are tabulated] showed that under the experimental conditions either yellow oxide of mercury or calomel may advantageously be used in the fertilizer to control scab [*Actinomyces scabies*: *R.A.M.*, xviii, p. 475]. The best results in terms of yield were given by yellow oxide at the rate of 4 lb. per ton, the 2 and 6 lb. treatments producing a smaller increase; and by calomel at the rate of 2 lb., the 4 and 6 lb. treatments giving an insignificant increase. On a basis of marketable, including slightly scabby, tubers, there is little advantage in using more than 2 lb. of either material. The tests in 1938 demonstrated conclusively that to be effective applications of either material must be made every year. Throughout the experiments the Green Mountain variety was more severely affected by scab than Irish Cobbler.

Further tests on the same lines with Green Mountain potatoes to study the effect of soil reaction on the treatment showed that the higher the P_H value of the soil, the greater is the total percentage of scabby tubers and the severity of attack. In these tests only the 4 lb. per ton dose of both materials was employed, and scab was effectively decreased over the range P_H 4·51 to 6. Severity of infection increased rapidly from P_H 5·26 to P_H 5·5, much of this increase occurring from P_H 5·31 to P_H 5·35. Above this point mercury treatment had little commercial value, and therefore is not recommended for soils with a high P_H value.

Blodgett (F. M.). **The effects of some agronomic practices on the incidence of Rhizoctonia.**—*Amer. Potato J.*, xvi, 4, pp. 93–98, 1939.

In the potato rotation experiments in progress in New York State since 1936, more infection (almost fivefold) by *Rhizoctonia* [*Corticium solani*] has been observed on tubers grown on the same plots for three successive years than on those in sites where longer rotations were operative [*R.A.M.*, xviii, p. 52]. In two instances the use of a 5–10–5 fertilizer (1,000 lb. per acre) reduced the number of diseased tubers, a similar effect being obtained with a rye cover crop, while a uniform decrease in the three localities selected for the tests followed the application of stable manure at the rate of 10 to 12 tons per acre. The best control of the fungus was secured by a combination of these three practices.

Leach (J. G.). **Tuber diagnosis of bacterial ring rot of Potatoes.**—*Plant Dis. Reptr*, xxiii, 6, p. 96, 1939. [Mimeographed.]

According to R. W. Goss's observations in Nebraska, the lemon-yellow colour of the vascular tissues of potatoes infected by bacterial ring rot [*Bacterium sepedonicum*: *R.A.M.*, xviii, p. 412] is very well marked and characteristic. The outer cortex often separates from the inner portion of the tuber along the entire affected zone of the vascular region. In many tubers showing these symptoms the pathogen is present in almost pure culture, and Gram-stained preparations made from such lesions usually demonstrate the presence of the causal organism of the ring rot in very large numbers. *Bact. sepedonicum* is easily isolated in pure culture on an appropriate medium if sufficient time is allowed for the development of the slow growing colonies.

Bonde (R.). **Bacterial wilt and soft rot of the Potato.**—*Amer. Potato J.*, xvi, 5, pp. 109–114, 3 figs., 1939.

A popular account is given of potato bacterial wilt and soft rot (*Phytomonas sepedonica*) [*Bacterium sepedonicum*: see preceding abstract]. Experiments in Maine have shown that the disease is perpetuated to the extent of 50 to 90 per cent. by means of the tubers, and that it spreads very rapidly in the field, especially on hill-side slopes, 15 to 40 per cent. infection having been observed in places where only a trace was present in the previous year. Contaminated seed stock is a source of dissemination, 60 to 80 per cent. infection developing in freshly cut seed pieces through contact with diseased tubers. Wilt is also spread by means of knives used for cutting seed, 60 per cent. infection arising from this source in the greenhouse and 30 to 40 per cent. in the field. The sole practical method of control is the use of healthy seed.

Fukushi (T.). **Retention of virus by its insect vectors through several generations.**—*Proc. imp. Acad. Japan*, xv, 5, pp. 142–145, 5 diags., 1939.

Evidence is presented for the protracted retention of the rice dwarf virus by females of the insect carrier *Nephotettix apicalis* var. *cincticeps* [*R.A.M.*, xvii, p. 562], in one instance for a period of over a year (7th April, 1938, to 24th April, 1939), or seven generations of the leafhopper. In the same experiment, infections were produced in more than 1,000 rice plants by 26 leafhoppers of five generations proceeding from one viruliferous egg. It would appear from these data that the virus multiplies within the bodies of the insect vectors, since the amount originally present in one egg must be infinitesimal.

Dennis (A. C.) & Dennis (R. W. G.). **Boron and plant life. Part III. Developments in agriculture and horticulture, 1937–38.**—Reprinted (with addition of bibliography) from *Fertil. Feed. St. J.*, 19 pp., 7 figs., 1939.

In continuation of the earlier work by R. W. G. Dennis on the same subject [*R.A.M.*, xvii, p. 63], the authors notice some 200 papers on work during the period under review, dealing with boron in relation to plant life.

Mulder (E. G.). **Über die Bedeutung des Kupfers für das Wachstum von Mikroorganismen und über eine mikrobiologische Methode zur Bestimmung des pflanzenverfügbaren Bodenkupfers.** [On the importance of copper for the growth of micro-organisms and on a microbiological method for the determination of the soil copper available for plants.]—*Arch. Mikrobiol.*, x, 1, pp. 72–86, 4 figs., 1 graph, 1939.

The writer's studies on the function of copper in the prevention and control of reclamation disease of oats and other cereals in Holland, and his description of the microbiological technique employed for the determination of the available quantities of the element in the affected

soils have already been noticed from other sources [*R.A.M.*, xvii, p. 623; xviii, p. 241].

JAMES (N.) & SUTHERLAND (MARJORIE L.). **The accuracy of the plating method for estimating the numbers of soil bacteria, actinomyces, and fungi in the dilution plated.**—*Canad. J. Res.*, Sect. C, xvii, 3, pp. 72–86, 9 graphs, 1939.

The accuracy of the plating method for estimating the soil population was subjected to statistical tests in Manitoba during 1936, 1937, and 1938 on 1,465 samples of field soil by comparing the mean counts of four replicate plates from one dilution with the theoretically expected values. Fungal counts of plates from a 1 : 5,000 dilution (plated one day after sampling) made after four days' incubation at 25° to 28° C. closely agreed with the expected values, and show that the method provides a reasonably accurate estimate of the population capable of developing under the conditions of growth. Counts of *Actinomyces* similarly conformed to expectation. On the other hand, bacterial counts, made of plates from 1 : 200,000, 1 : 800,000, or 1 : 500,000 dilutions showed higher values than the expected ones when samples were plated one day after they were taken from the field, but conformed to expectation when plating was done within a few hours of sampling. Plates with large numbers of pin-point colonies or overgrown with Mucorales gave abnormally high values and should be excluded from bacterial counts. It is concluded that the plating method provides a satisfactory estimate of the bacterial population of soil provided the plating is carried out within six hours of sampling.

JAMES (N.) & SUTHERLAND (MARJORIE L.). **The accuracy of the plating method for estimating the numbers of bacteria and fungi from one dilution and from one aliquot of a laboratory sample of soil.**—*Canad. J. Res.*, Sect. C, xvii, 4, pp. 97–108, 1939.

In further tests of the plating method for estimating the soil population [see preceding abstract], six 25 gm. aliquots taken from a soil sample were each plated in six replicate dilutions with four replicate plates from each dilution for fungal counts, and for bacterial counts each replicate dilution was raised and the final dilutions plated in four replicates. The data for fungal counts showed no significant differences among replicate dilutions from one aliquot, but only among aliquots taken from the same soil sample, while in bacterial counts significant differences existed both among dilutions from one aliquot and, as established in several further experiments, among aliquots taken from the same soil sample. The variation among aliquots was much greater than that among replicate dilutions of one aliquot. None of the technical operations added anything significant to the error of plating. These data show conclusively that one 25 gm. aliquot does not provide an accurate estimate of the population of fungi or bacteria in the soil sample. It is suggested that six aliquots should be plated in three replicate dilutions with one plate for each dilution. The practical value of the plating method thus appears to be rather limited, but it may be improved by carefully designed experiments and the application of statistical methods.

Annual Report on the Department of Agriculture, Zanzibar Protectorate, 1938.—38 pp., 1 graph, 1939.

In the section of this report (pp. 17–19) dealing with sudden death of cloves in Zanzibar [*R.A.M.*, xviii, p. 548] A. H. Campbell states that the symptoms are those of a rapid wilt and subsequent death and drying out of the leaves. Almost entire loss of the absorbing root system has already occurred when these symptoms first become apparent. Possibly the disease of the roots may be of long standing, the final phase of leaf wilting and discoloration being induced by the coincidence of several factors, mainly the drying power of the atmosphere. This view is supported by the fact that most of the trees die off between December and April, when high temperatures accompanied by strong winds prevail. Affected trees tend to occur in groups, and areas previously severely affected continue to show many losses, which appears to indicate that infection spreads from tree to tree, or, less probably, that a predisposition to 'sudden death' is brought about by soil conditions.

The relation of clove die-back [ibid., xvi, p. 301] to 'sudden death' is as yet obscure. The fact that trees affected by die-back do not recover as vigorous trees should if affected only by mechanical injury would indicate that such injury is not the only cause of the condition.

No evidence was obtained of phloem necrosis, or of the presence of flagellates, in connexion with 'sudden death'. Pycnidia of a member of the Sphaeriodeae were found on the dead rootlets and roots of all of 84 affected trees examined, and similar pycnidia were observed in connexion with severe die-back.

As little appears to be known of the distribution of 'sudden death' in Zanzibar, apart from the Government gardens, a survey of the incidence of the disease and of severe die-back has been undertaken.

Rud (P. I.). Історія розвитку **Sphaerotheca fuliginea Poll.** на **Calendula officinalis L.** [The life history of *Sphaerotheca fuliginea* Poll. on *Calendula officinalis* L.].—*Тр. Инст. Бот. Харк. Унив.* [*Trav. Inst. Bot. Univ. Kharkoff*], iii, pp. 79–101, 11 figs., 1938. [English summary. Received June, 1939.]

Sphaerotheca [*humuli* var.] *fuliginea* [*R.A.M.*, xviii, p. 84] was found attacking *Calendula officinalis* in several parts of Kharkoff, Russian Ukraine, at the end of July. The conidia germinate in rain water at 12° to 30° C., the optimal temperature being 22° to 26°. Artificial infection with either ascospores or conidia was successful in nature as well as in the laboratory at 15° to 20°, the incubation period being three to five and five to seven days, respectively. Ascospores develop in the autumn but mature completely only in July of the following year. No noticeable damage is caused to the plant until the leaves become densely covered with the mycelium and dry up. It is suggested that at least the first yield of the ligulate flowers can be saved by sowing early. In cross-inoculation experiments the author established three distinct physiologic races: forma *calendula* Jaczewski, f. *bidentis* Jaczewski, and f. *taraxacum* Potebnia, of which the first is only capable of infecting *C. officinalis*, the second only *Bidens tripartitus*, and the third only *Taraxacum officinale*.

KOMIRNA (Mme O. M.). **Erysiphe umbelliferarum D.B. f. anethi Jacz. на Foeniculum officinale All.** [*Erysiphe umbelliferarum* D.B. *f. anethi* Jacz. on *Foeniculum officinale* All.]—*Тр. Инст. Бот. Харк. Унив.* [*Trav. Inst. Bot. Univ. Kharkoff*], iii, pp. 103–106, 1 fig., 1938. [Received July, 1939.]

The author records *Erysiphe umbelliferarum* f. *anethi* for the first time on fennel (*Foeniculum officinale*) [*F. vulgare*] in the Botanical Gardens at Kharkoff, Russian Ukraine. The fungus is considered to be identical with the species described by Jaczewski on dill (*Anethum graveolens*) in spite of certain discrepancies in measurements, ascribed to different ecological conditions and in part to inadequate data in Jaczewski's description. For instance, Jaczewski gives no measurements for conidia and appendages, his ascocarps measure 100 to 110 μ in diameter, asci (usually three) 60 by 45 μ, and ascospores (usually three to four) 20 to 25 by 12 μ, while in the isolation from fennel the conidia measure 31 to 43·4 by 12·4 to 17·5 μ, the ascocarps 84 to 118 (up to 127) μ in diameter, 102 to 185 μ long, asci (usually 4 to 5) 59 to 71 by 31 to 43·4 μ, and ascospores (usually 4 to 5) 18·6 to 24·8 by 10·8 to 15·5 μ. Both fennel and dill plants inoculated in the laboratory with the conidia of the species from fennel developed the conidial stage after eight to ten days, and subsequently ascocarps.

RYKER (T. C.). **The Rhizoctonia disease of Bermuda Grass, Sugarcane, Rice, and other grasses in Louisiana.**—*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 198–201, 2 figs., 1939.

In Louisiana, Bermuda grass (*Cynodon dactylon*) is frequently infected by *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xii, p. 355] after showery periods in summer. Infection appears in rather definite, gradually spreading areas in the field, in which every plant shows severe blight of the leaves and leaf sheaths, which bear large, irregular, bleached spots with reddish-brown margins. The roots appear to remain unaffected, and the stems show only slight attack. Many other grasses in the affected areas are attacked.

Towards the end of July, 1938, a field of sugar-cane showed a high percentage of plants infected by *C. solani*, the disease being in every instance associated with affected plants of Bermuda grass in contact with the sugar-cane. On the older sugar-cane plants the injury was confined to the lower leaves and leaf sheaths, but on the young suckers emerging from the base of the stool all the aerial parts were affected. The diseased leaves bore large, irregular, bleached areas with reddish-brown margins, which, where whole leaves were affected, formed bands across the leaf. These symptoms closely resemble those described by A. F. Bell for 'banded sclerotial disease' (*Bull. Div. Path. Sug. Exp. Sta. Qd* 2, 1929) [*R.A.M.*, xi, p. 203, and below, p. 626], and by F. S. Earle for banded sheath spot, attributed to *R. grisea* [ibid., ii, p. 261].

The common sheath spot of rice in Louisiana is caused by *R. oryzae* [ibid., xvii, p. 622], but occasionally *C. solani* produces similar symptoms. In very wet weather a strain of the latter fungus may grow up over the whole rice plant, producing symptoms closely resembling those on sugar-cane and Bermuda grass. In several instances, Bermuda

grass growing along the edge of rice fields containing affected plants showed injury from the fungus. The organism involved was in every instance a strain of *C. solani* producing large, distinct, irregular, greyish-white, later greyish-black sclerotia, flattened on the bottom and rounded on top, on the surface of the culture media and sometimes on the host and the soil of the affected areas. This appears to be the fungus described by Matz as *R. grisea* on the aerial parts of sugar-cane in Puerto Rico [ibid., i, p. 274]. It also resembles the fungus found on rice and other plants in the East, and variously described as *Hypochnus* [*C.*] *sasakii* [ibid., xiv, p. 795; xv, p. 49] and *R.* [*C.*] *solani* [ibid., vi, p. 252; xiii, p. 725]. The Louisiana strain (or strains) differs from the common strain of *C. solani* associated with root rot and damping-off of various plants in Louisiana, the latter producing small sclerotia or only indefinite masses of sclerotial cells in culture.

TIMS (E. C.). **Dwarf or multiple bud disease of Sugarcane in Louisiana.**—*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 467–471, 6 figs., 1939.

In 1928, P.O.J. 234 sugar-cane growing in Louisiana showed a condition closely resembling the dwarf disease reported from Australia [*R.A.M.*, xvi, p. 61]. Isolated stools of small, stunted, grass-like cane were also noted on P.O.J. 979, 2714, and 2725, but most of the affected stools in these varieties developed some normal stalks before the end of the season. One field of P.O.J. 234 plant cane in a low, poorly drained locality showed heavy infection. Occasionally, a dwarfed stool was noted in plantings of P.O.J. 234 in other parts of Louisiana, but little or no spread occurred except in Orange Grove. Transmission was ascertained to occur through the stubble.

Yearly plantings were made from diseased P.O.J. 234 material collected in 1928 up till 1937, and dwarfed, yellow stools were produced every year, but no natural spread has occurred. Of late years the diseased plants all died after the first year.

In Louisiana the affected stools are much stunted, and consist of a bunch of very small shoots emerging from a central point. As many as 50 shoots may be present in one stool, mostly not over 12 in. high. Some stools show one or two stalks 2 to 4 ft. high, with numerous small, proliferated shoots at the nodes. Many of the small shoots die during the growing season. The leaves on affected plants are pale yellow and quite small, and the older ones show reddish, necrotic spots. All attempts at artificial transmission failed.

EDGERTON (C. W.). **Stubble deterioration.**—*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 334–342, 1 graph, 1939.

Most sugar-cane varieties now grown in Louisiana are highly resistant to stubble deterioration [*R.A.M.*, xiv, p. 469], though different varieties are not necessarily affected by identical deterioration factors. For some years all sugar-cane varieties and promising introductions have been submitted in Louisiana to stubble deterioration tests. If the percentage of good eyes on stubbles under test is compared with the percentages found on varieties of known resistance or susceptibility, the stubble deterioration characteristics can be determined with some accuracy.

Susceptible varieties are classed as dangerous canes, and in future will not be released.

Le Beau (F. J.). **The relation of environmental factors and antagonistic organisms to root rot of Sugarcane and Corn.**—*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 342–347, 3 figs., 1939.

In greenhouse and field experiments conducted from 1936 to 1938 in Louisiana the growth of maize and sugar-cane was studied in different types of soil, at different P_H values, at different temperatures, and under various nutrient conditions, with special reference to the effect of these variations on the action of *Pythium* organisms infecting the roots and of *Trichoderma* spp. attacking the *Pythium*.

The data obtained showed that low temperatures favoured *Pythium* attack. Changes in the P_H value had no appreciable effect. Applications of nitrates increased root rot, while high phosphate treatments reduced it. On the whole, neither nitrates nor phosphates had any marked effect on the antibiotic action of *Trichoderma* against *Pythium*. A strain of *Trichoderma* from New Jersey was much more antagonistic to the *Pythium* than most of the cultures from Louisiana.

Rands (R. D.) & Dopp (E.). **Pythium root rot of Sugarcane.**—*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 680–681, 1939.

This is an abstract of a paper already noticed from another source [*R.A.M.*, xviii, p. 343].

Abbott (E. V.). **Cytospora rot of Sugarcane in Louisiana.**—*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 447–457, 2 figs., 1939.

After describing the symptoms of sugar-cane infection by *Cytospora sacchari* [*R.A.M.*, xviii, p. 139], the author discusses its importance as a disease of the leaf sheaths, seed cuttings, and stubble rhizomes in Louisiana. Losses result from reduced stands of plant cane brought about by deterioration of the seed cuttings, while the disease also reduces the yields of cane by killing the suckers. The disease does not appear to be of importance as a cause of stubble deterioration.

Two years' field tests with C.P. 28/19 indicated that the mortality of suckers from sheath infection was insignificant among those originating early in the season, but that the disease might reduce the weight of millable stalks from such suckers by from 13 to 22 per cent. The mortality among suckers appearing in late May or early June ranged from 67 to 85 per cent., and the loss in cane weight from infected shoots from 79 to 85 per cent. As compared with unfertilized cane, cane given nitrogen fertilization in normal or excessive quantities showed marked reduction in the percentage of sheath infection.

Field observations on the intensity of sheath infection showed C.P. 28/19 and C.P. 29/320 to be highly susceptible, C.P. 807, C.P. 28/11, and Co. 281 to be susceptible, and Co. 290 and P.O.J. 36, 213, and 234 to be resistant. Under Louisiana conditions varieties of *Saccharum*

officinarum, *S. barberi*, *S. sinense*, and *S. spontaneum* were resistant, severe damage being confined to certain hybrids of complex inheritance.

Abbott (E. V.). **Red rot of Sugarcane.**—*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 682–683, 1939.

This is a summary by the author of a study of red rot (*Colletotrichum falcatum*) of sugar-cane already noticed from another source [*R.A.M.*, xviii, p. 344].

Atkinson (R. E.). **On the nature of resistance of Sugarcane to red rot.**—*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 684–692, 5 figs., 1939.

Investigations carried out in Louisiana into the nature of the lateral and longitudinal spread of *Colletotrichum falcatum* [see preceding abstract] in sugar-cane stalks demonstrated that spore migration in the ducts of the fibrovascular bundles is the cause of spread up and down in stalks inoculated by boring [*R.A.M.*, xvii, p. 68]. As the injury to cane stalks increases in proportion to the number of spores of *C. falcatum* introduced, it is desirable, when studying the comparative pathogenicity of isolates, to use approximately equal spore concentrations in inoculations.

Some varieties, owing to the fact that comparatively few vessels extend continuously from one internode to another, show morphological resistance to spore spread. In certain varieties, lateral growth of the mycelium from the vessels is inhibited, the lesions, as a result, being small, and the injury reduced. Physiological resistance to lateral spread in the node and morphological resistance to longitudinal spread combine to give C.P. 29–320 its so-called 'tolerance'. C.P. 29–116, regarded as resistant by some workers and susceptible by others, has the greatest resistance to longitudinal spread but lacks marked resistance to lateral, while with Co. 281 the reverse obtains. Resistance to lateral spread may not prove effective against some physiologic races of *C. falcatum*, but the morphological resistance shown by C.P. 29–116 may be expected to remain a constant character.

Rodrigues (A. J.). **Behavior of Co. 290 in São Paulo.**—*J. Agron., S. Paulo*, ii, 1, pp. 9–20, 1939. [Portuguese. Abs. in *Facts ab. Sug.*, xxxiv, 7, p. 39, 1939.]

The prolific Co. 290 sugar-cane variety, introduced into São Paulo, Brazil, in 1930, is resistant to mosaic [*R.A.M.*, xviii, p. 346], susceptible to, but tolerant of, red rot [*Colletotrichum falcatum*], and has been reported elsewhere to be immune from gummosis [*Bacterium vasculorum*] and streak.

Grillo (H. V. S.). **On the red stripe of Sugarcane in Brazil.**—*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 427–430, 2 figs., 1939.

In a trial of varietal resistance in sugar-cane to red stripe disease (*Bacterium rubrilineans*) [*R.A.M.*, xvi, p. 127; xviii, p. 274] carried out in Rio de Janeiro, P.O.J. 36 was very susceptible, P.O.J. 2878 susceptible, and P.O.J. 161 and 2725 resistant or tolerant. In another experiment at Campos, P.O.J. 36 was not markedly susceptible, and the varieties most

susceptible in this locality were those least affected at Rio de Janeiro. This disparity is attributed to differences in the climates of the two localities, particularly as regards humidity. Top rot is a characteristic symptom under very humid conditions and may cause appreciable injury.

Isolations on Liebig's agar from red stripes of the leaf and infected top joints of P.O.J. 36 produced milky-white colonies, which saccharified starch, produced hydrogen sulphide but not indol, and utilized nitrogen in the form of ammonia. Repeated inoculations gave some positive results, especially on one- to four-months'-old plants during a rainy period when the [atmospheric] humidity amounted to 85 per cent.

McMartin (A.). **Some preliminary trials on the control of sett-rot in Natal.**—*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 457–461, 1939.

In an experiment carried out in Natal to explore the possibility of improving sugar-cane germination and stands by preventing sett rot [*R.A.M.*, xvi, p. 774] due to soil fungi, attack by which is favoured by the dry conditions for planting sugar-cane locally, the trashed cuttings were dusted with ceresan and agrosan, and the results compared with those given by watering the soil before planting with formalin, Cheshunt compound, and cresylic acid. Germination counts based on four replications of each treatment with a known number of planted buds per plot showed significant increases, as compared with the untreated controls, only in the plots given the two mercurial treatments (60 per cent. germination, as compared with 29·5 per cent. for the controls). Ceresan reduced the time required for germination to take place by nearly a week, with resultant acceleration of the rate of tillering, the ceresan-treated plots, after two months, during which a period of drought occurred, showing five times as many tillers as the controls.

In a pot test under glass abavit, agrosan, and ceresan dusts were applied to the varieties. Co. 281, Co. 290, and Co. 301 under dry, optimum, and waterlogged soil conditions. No varietal difference in response was noted and the treatments increased germination significantly only under the dry conditions. Soaking the cuttings in a soluble form of ceresan killed the young buds and retarded shoot growth from the older ones.

A comprehensive field test was carried out on a clay and also on a light sandy soil, using ceresan and agrosan, to ascertain whether the dust was as effective when applied in the furrow at planting as when applied to the cuttings before planting, and further, to determine whether the efficacy of the dust was impaired if it was used when mixed with artificial fertilizer. The varieties tested were Co. 281, Co. 290, and Co. 301. The results demonstrated that application in the furrow was effective only on the sandy soil, and when the fungicide was not mixed with fertilizer. When the experiment was repeated in pots under glass, Co. 301 (a poor germinating variety) gave a better response to the treatments than did the others. Germination of the untrashed cuttings was increased from an average of 46 per cent. in the untreated controls to one of 70 per cent. in the treatments. It is concluded that, if a satisfactory method of applying the dust can be devised, sett treatment with organic mercury compounds can be of much advantage under Natal conditions.

Summers (E. M.). **A study of the common mosaic of Sugarcane with special reference to strains of the virus.**—Abs. in *Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 564–565, 1939.

The author recognizes and designates by letters ten strains and sub-strains of the common sugar-cane mosaic virus [*R.A.M.*, xvi, p. 276], strains A to D corresponding to the four strains previously described [ibid., xiv, p. 123].

Strain A produces ordinary mosaic symptoms. Strains B and C produce severe chlorosis and some necrosis in the sugar-cane variety C.P. 31/294 but the latter fails to produce the typical sheath discoloration and stunting in C.P. 29/291. Strain C causes a severe mosaic pattern in Co. 281, usually accompanied by some necrosis, and often blights or kills the growing part of C.P. 31/294 seedlings. Strain D and its substrains Da, Db, and Dc cause similar symptoms in C.P. 31/294 but D causes ordinary symptoms in Co. 281, which shows a high percentage of germination recovery to Da, gives a mild necrotic response on the older leaves to Db, and scattered purplish leaf lesions to Dc. Co. 281 is very resistant to strain E and recovers from it, while strain F on C.P. 31/294, Co. 281, and C.P. 29/291 causes a fine regular pattern, often nearly masked, but produces necrosis and stunting in C.P. 807, a variety long considered immune from mosaic.

The results of a survey of the distribution of these strains in Louisiana are briefly indicated.

Shaffer (M. L.). **Seed selection and roguing in the practical control of mosaic disease of Sugarcane in Louisiana.**—*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 554–563, 1939.

In tests carried out in Louisiana in 1937 and 1938 plots in representative areas of the sugar belt were planted with selected seed of the chief sugar-cane varieties and rogued for mosaic throughout the season, records being made of the extent and cost of the procedures. Other test plots surrounded by mosaic cane were planted but under the conditions obtaining only slight mosaic infection occurred.

The results obtained [which are tabulated] indicated that seed selection alone may reduce the percentage of mosaic in non-isolated plots to one-third or one-fourth of that present in the field-run cane, and that if roguing is practised as well as seed selection the disease can be virtually eliminated in some, and controlled in all varieties. Comparisons of the yields from the healthy and mosaic cane considered in relation to the cost of seed selection and roguing indicate that the operations in question are of practical interest wherever losses from mosaic are appreciable or likely to become so.

Forbes (I. L.). **Immunity studies with Sugarcane mosaic.**—*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 566–572, 1939.

In investigations into the identity of different sugar-cane mosaic viruses present in Louisiana [*R.A.M.*, xvi, p. 276; xvii, p. 68] the green and yellow mosaics of C.P. 28–70 were passed separately through

Co. 281, C.P. 28–70, and through maize, and back to C.P. 28–70, retaining their identities. When the same two viruses were mixed in equal quantities, by volume, of expressed plant juices, and were passed through either of these two sugar-cane varieties or maize and back to C.P. 28–70, the symptoms produced demonstrated almost invariably that only one of the two strains inoculated into the first variety gave rise to the symptoms produced. Similar results were obtained by passing the yellow mosaic viruses of C.P. 28–11 and C.P. 28–19 through maize and back to C.P. 28–11 and C.P. 28–19, respectively, and to C.P. 28–70. The results indicate that the mosaics in question are due to single viruses, and not to mixtures.

The inoculation of C.P. 28–70 plants showing green mosaic with yellow mosaic virus and of plants showing yellow mosaic with green mosaic virus showed that the green mosaic produces immunity against yellow mosaic, and the yellow mosaic against green mosaic. Healthy plants inoculated with the green mosaic virus of C.P. 28–70 are generally immune from infection when the yellow mosaic is inoculated into them four days later, whereas plants inoculated first with the yellow mosaic virus and then the green showed some with green mosaic and some with yellow mosaic. The very mild mosaic sometimes present in Louisiana Purple sugar-cane does not protect this variety against severe mosaic, nor does it confer immunity from the yellow mosaic of C.P. 28–70.

Matz (J.). **Comparative study of Sugarcane mosaic in different countries.** —*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 572–580, 2 figs., 1939.

The author points out that an important factor in the spread of sugar-cane mosaic is the virulence, specificity, and transmissibility of the chief strains of the virus occurring in the localities concerned [cf. *R.A.M.*, xviii, p. 346]. Mosaic virus from four different sugar-cane varieties originating in one large geographical zone in the Pacific Islands intercepted on three separate occasions proved to be innocuous and transmissible only with difficulty to the susceptible varieties P.O.J. 234, C.P. 28/60, and Louisiana Purple in quarantine. The strain obtained from H–109 from Hawaii produced no perceptible symptoms when transferred in quarantine to C.P. 28/60 and 31/294, though unmistakable symptoms were produced on all the plants of these varieties inoculated with common strains from Louisiana. The evidence so far obtained indicates that in the Pacific region there exists strains of mosaic less virulent and less easily transmitted to sugar-cane varieties susceptible to the Louisiana strains than are these latter strains themselves. Other work indicated that two strains from Puerto Rico, one from Spain, and one from India were identical with the moderately severe and highly infectious sugar-cane virus 1 B Summers (formerly designated strain 2) in Louisiana [ibid., xvi, p. 276].

Sorenson (H.). **The behavior of mosaic on certain soils and mosaic in regard to Cane breeding.**—*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 357–360, 1939.

Studies conducted by the author in Cuba showed that spread of sugar-cane mosaic [see preceding abstracts] was virtually nil on the red

lands (Matanzas clay, Perico clay, and Truffin soils) in Camaguey and Matanzas Provinces, whereas on other soils in Pinar de Rio, Santa Clara, and Oriente Provinces the rate of spread was high. Further investigations in Colombia revealed similar differences in rate of spread in different localities. The highly susceptible standard variety Caña Blanca (Otaheite) showed very little mosaic, with a very slow rate of spread, in the fertile, alluvial, sandy soils in the lower part of the Palmira valley, but in the higher parts near the eastern mountains spread was so rapid that plantings from clean seed of susceptible varieties showed nearly 100 per cent. infection four or five months after planting.

A test was then carried out in Colombia in which rows of 100 per cent. mosaic Caña Blanca were planted with alternate rows of healthy seed of a few susceptible and moderately resistant varieties. In five months all the Caña Blanca canes developed mosaic, while the remainder showed 25 to 40 per cent. infection. As soon as a stool showed the disease it was treated with small amounts of manganese, copper, zinc, lead, boron, iodine, and chromium. A month later, the symptoms had disappeared from several of the moderately resistant varieties treated, and from a few of the treated susceptible varieties. From this result it is tentatively concluded that the presence of these elements, or some of them, in the soil may partly or wholly check mosaic, and that the difference between susceptible and resistant varieties may result from the greater ability of the latter to absorb very small amounts of these elements.

Report on the work of the Department of Science and Agriculture for the year ending March 31st, 1938.—*Agric. J. Barbados*, vii, 2, pp. 27–85, 2 col. graphs, 1938. [Received May, 1939.]

On p. 35 of this report it is stated that in Barbados sugar-cane mosaic [*R.A.M.*, xiii, p. 803] is kept in check by official inspection and the distribution of clean planting material to small growers in proclaimed areas. Two varieties so distributed during the period under review were B. 3254 and B. 35187, both bred in Barbados and derived from P.O.J. 2725 crossed with Barbados seedlings. Gumming disease [*Bacterium vasculorum*: ibid., xviii, p. 269] is now completely controlled as a result of the growing of resistant seedlings; it is, however, still present, and the situation is being kept under careful observation.

Report on the British West Indies Central Sugar-Cane Breeding Station for the year ending September 30th, 1938.—31 pp., 14 diags., [? 1939].

Roguing for the control of sugar-cane mosaic, though practised in Barbados [see preceding abstract], is impracticable in certain other West Indian islands, including parts of Jamaica, and therefore one of the major projects of the Barbados breeding station is the production of high yielding, resistant, good quality seedlings. Tests by artificial inoculation having proved no more reliable than the natural infection method, the latter is now exclusively used, the seedlings under test being laid out in single row plots and separated by alternate rows of susceptible canes and maize. Inspections are made at fortnightly intervals, and

seedlings developing no symptom in 14 to 16 months are regarded as commercially resistant.

Stevenson (G. C.). **Breeding and testing Sugarcane seedlings for mosaic disease resistance at the British West Indies Central Sugar Cane Breeding Station, Barbados.**—*Proc. sixth Congr. int. Soc. Cane Tech., Baton Rouge, 1938*, pp. 71–75, 1939.

Most of the information in this paper has already been noticed from other sources [see preceding abstract].

Stevenson (G. C.). **Breeding and testing Sugarcane seedlings for gumming disease resistance at the British West Indies Central Sugar Cane Breeding Station, Barbados.**—*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 75–78, 1939.

The information in this paper has already been noticed from another source [*R.A.M.*, xvii, p. 269].

Bitancourt (A. A.). **Diseases of the Sugarcane in Brazil.**—*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 187–193, 1 fig., 1939.

In Brazil, the principal sugar-cane disease is mosaic [*R.A.M.*, xvi, p. 126], which has now been reported from nearly all the sugar-cane growing areas in the country. It markedly decreased production before the introduction of resistant varieties. Resistance appears to vary widely with different climatic conditions. Other sugar-cane virus diseases present are sereh [loc. cit.] and streak. Gummosis [*Bacterium vasculorum*: loc. cit.] is now comparatively unimportant, owing to the use of resistant varieties. Root disease (*Marasmius sacchari*, *Schizophyllum commune*, *Sclerotium rolfsii*, and other fungi, possibly in conjunction with unfavourable soil conditions), top rot (*Fusarium moniliforme*) [*Gibberella fujikuroi*], and red stripe disease attributed to *Phytomonas* [*Bacterium*] *rubrilineans* [loc. cit.] are also factors in reduction of yield, and are accompanied by secondary or minor organisms such as *Melanconium* [*Pleocyta*] *sacchari* [ibid., xvii, p. 839; xviii, p. 274] and *Diplodia* [*Botryodiplodia*] *theobromae*. *Ceratostomella paradoxa* [ibid., xvi, p. 774] causes a failure of cuttings.

The principal leaf diseases are *Leptosphaeria sacchari* [ibid., xvii, p. 839], possibly secondary to leaf spots caused by *Helminthosporium sacchari* [ibid., xvi, p. 127] and *H. stenospilum* [loc. cit.], *Cercospora vaginae* [ibid., xvii, p. 843], *C. longipes* [ibid., xvi, p. 206], and the leaf spot associated with *Pyrenochaeta* [*sacchari*: ibid., xviii, p. 346].

Other records include *Gnomonia iliau* [ibid., ix, p. 807], cold [banded] chlorosis [ibid., xvi, p. 561], and *Myriogenospora aciculisporae* [ibid., xvi, p. 599].

Hughes (C. G.). **Alternate hosts of Bacterium vasculorum.**—*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 430–437, 1 fig., 1939.

In most parts of Queensland gumming disease (*Bacterium vasculorum*) [*R.A.M.*, xviii, p. 274], owing to the use of resistant varieties, is rapidly disappearing from commercial plantings of sugar-cane. In cross-

inoculation studies inoculation of *Bact. vasculorum* into the following plants gave positive results: dent and sweet maize, ten varieties of sweet and grain sorghum, *Sorghum verticilliflorum*, *S. sudanense*, Para grass (*Brachiaria mutica*), *Pennisetum purpureum*, and *S. halepense*. When infection passed from one host to another the symptoms varied widely, but leaf streaks containing patches of dead tissues were present on all, and systemic infection somewhat resembling that found in sugar-cane occurred in maize and sorghum. Gumming was also transmitted from sugar-cane to maize under natural conditions. These results suggest that the disease may have a very wide host range. This possibility should be borne in mind before releasing susceptible varieties for planting in a locality previously affected.

ORIAN (G.). **Natural hosts of Bacterium vasculorum (Cobb) Gr. Smith in Mauritius.**—*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 437–447, 4 figs., 1939.

The work described in this paper on natural hosts of *Bacterium vasculorum* in Mauritius has already been noticed from another source [*R.A.M.*, xviii, p. 374].

ROSENFELD (A. H.). **Minor Sugarcane diseases in Egypt.**—*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 194–198, 1939.

The only major diseases of sugar-cane present in Egypt are streak [*R.A.M.*, xvii, p. 555] and mosaic [ibid., xii, p. 749], of which the former is much the more important. The minor diseases found (which do not, as a rule, cause appreciable damage) include *Helminthosporium sacchari*, *Leptosphaeria sacchari*, non-infectious chlorosis, rust (probably *Puccinia kuehnii*) [ibid., xvi, p. 561], *Colletotrichum falcatum*, *Cephalosporium sacchari*, *Melanconium* [*Pleocyta*] *sacchari*, *Thielaviopsis* [*Ceratostomella*] *paradoxa*, root rot associated with *Pythium*, *Marasmius*, *Himantia*, or *Fusarium* (of which only the first can be regarded as aggressive, and then only on weakened canes), *Marasmius sacchari* on old leaf sheaths and rhizomes, and, occasionally, *Himatia stellifera* [ibid., xvii, p. 299].

OCFEMIA (G. O.). **A review of Sugarcane diseases in the Philippines.**—*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 183–187, 1939.

Notes are given on the major diseases of sugar-cane found in the Philippine Islands, viz., leaf scald (*Bacterium albilineans*) [*R.A.M.*, xviii, p. 274], downy mildew (*Sclerospora sacchari*) [loc. cit.], smut (*Ustilago scitaminea*) [ibid., xvii, p. 839; xviii, p. 477], mosaic, and Fiji disease [ibid., xviii, p. 274], as well as on the following minor troubles, most of which may cause serious losses under suitable climatic and environmental conditions: *Pythium* root rot (apparently *P. graminicolum*) [ibid., xviii, p. 343], ring spot (*Leptosphaeria sacchari*) [ibid., xvii, p. 839], ergot (caused by an undetermined species of *Claviceps*) [ibid., x, p. 440], *Bakerophoma sacchari* [ibid., ii, p. 109], sooty mould [*Meliola arundinis*: loc. cit.], red rot (*Colletotrichum falcatum*) [see above, p. 619], rind disease, attributed to *Melanconium* [*Pleocyta*] *sacchari* [see preceding abstract], wilt (*Cephalosporium sacchari*) [ibid., xviii, p. 500], yellow spot

(*Cercospora kopkei*) [ibid., xv, p. 346], *Fusarium moniliforme* [*Gibberella fujikuroi*: ibid., xvii, p. 162], *Helminthosporium sacchari* [ibid., xiii, p. 12], pineapple disease (*Thielaviopsis* [*Ceratostomella*] *paradoxa* [ibid., xvi, p. 693], shoot rot (*Sclerotium rolfsii*) [ibid., xvi, p. 127], banded sclerotial disease (*Rhizoctonia* [*Corticium*] *solani*) [ibid., xi, p. 203], rust (*Puccinia kuehnii*) [see preceding abstract], *Marasmius* sheath rot, and 'buñga' caused by the parasitic flowering plant *Aeginetia indica* [ibid., ii, p. 109].

OCFEMIA (G. O.) & CELINO (M. S.). **Some recent findings regarding Fiji disease of Sugarcane in the Philippines.**—*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 550–554, 2 figs., 1939.

Further studies on Fiji disease of sugar-cane in the Philippine Islands [see preceding abstract] have demonstrated that the disease is transmissible not only by adults but also by second, third, fourth, and fifth instar nymphs of *Perkinsiella vastatrix* [ibid., xvi, p. 125], one adult insect being sufficient to effect transmission. In a diseased cane, the virus may not be distributed throughout the infected stalk.

KIRYU (T.) & OKADA (M.). **Sclerotic disease of Sugarcane.**—*Proc. sixth Congr. int. Soc. Sug. Cane Tech., Baton Rouge, 1938*, pp. 785–792, 5 figs., 1939.

In this paper the authors give a preliminary account of investigations into a 'sclerotic disease' of sugar-cane in Formosa. The parenchyma of old cane stems becomes brown, the cell walls are sclerotic, and the affected parts are hard. No symptoms are apparent on the outside of the stem. The lower part of the cane appears to be more susceptible than the rest. A brownish, granular substance is present in the affected parenchymatous cells and the walls of the affected cells of some varieties are sometimes thicker than those of healthy ones and show more distinct lignification. Inoculation experiments all gave negative results, and the disease did not increase when affected cuttings were planted. The disease, which appears to be of physiological origin, does not seem to be fatal, but it decreases the sucrose and increases the reducing sugars and fibre present. The varieties P.O.J. 2725, 2883, and 2878 are, respectively, very susceptible, moderately resistant, and intermediate.

BALDACCI (E.). **Contributo alla sistematica degli Attinomiceti. II, III, IV, V–VIII.** [A contribution to the systematics of the Actinomycetes. II, III, IV, V–VIII].—*Atti Ist. bot. Univ. Pavia*, Ser. IV, ix, pp. 299–314, 1 fig., 1937; x, pp. 3–37, 9 figs., 1937; x, pp. 321–329, 3 figs., 1938; xi, pp. 191–231, 13 figs., 1939. [Latin and English summaries.]

In these papers the author continues his studies on the systematic position of a large number of species of Actinomycetes [*R.A.M.*, xvii, p. 457].

FISHER (EILEEN E.). **A study of Australian sooty moulds.**—*Ann. Bot., Lond.*, N.S., iii, 10, pp. 399–426, 1 pl., 1 fig., 3 graphs, 1939.

Following a review of the pertinent literature and a critical discussion of recent outstanding contributions to the study of sooty moulds

[*R.A.M.*, xvi, pp. 279, 699], the writer considers the taxonomy of the group and proposes a system of classification based mainly on the macroscopic appearance of their growth. The diagnostic features of six families are given, viz., the Capnodiaceae v. Höhn. emend. E. Fisher, Chaetothyriaceae Th. emend. E. Fisher non Chaetothyrieae Theiss. & Syd. 1917, Microthyriaceae Sacc., Trichopeltaceae Th., Perisporiaceae Fr., and Atichiaceae Millardet emend. Raciborski. Within each family the separation of genera may usually be effected by reference to such ascospore characters as septation and colour, but an exception to this rule is constituted by the Atichiaceae, in which conidial development furnished a more reliable criterion. The sooty moulds further fall into two categories according to their mode of nutrition, namely (*a*) epiphytes, growing in a purely saprophytic manner on 'honey dew'-covered plants and able to develop on culture media, and (*b*) ectoparasites, producing an abundant superficial mycelium but also extracting nutriment from their hosts; these species have not yet been obtained in pure culture.

A tabulated account is then given of the writer's cultural studies at Melbourne University on eight fungi isolated from local epiphytic sooty moulds, i.e., a new species of *Phycopsis* to be described elsewhere, *Capnodium salicinum* [ibid., xv, pp. 25, 530], *Fumagospora* sp., *Hendersoniella* sp., *Antennularia* sp., *Microxyphium* sp., *M. leptospermi* E. Fisher, and *Pleospora herbarum*. The organisms were grown on a medium of 2 per cent. agar and 5 per cent. honey at a temperature range of 10° to 25° C. *Phycopsis* sp. developed best at 15°, whereas the optima for the other species (not including the unspecialized sooty mould component, *Pleospora herbarum*, which flourished at 25°) were found to lie between 18° and 20°, a rapid decline in growth, except in the cases of *A.* sp. and *M. leptospermi*, being associated with a rise above the optimum in the temperature scale. *P. herbarum* was the only one of the experimental fungi succumbing to three days' exposure to a temperature of —10°, followed by ten days at 18°. None of the organisms made any growth at a relative atmospheric humidity of 90 per cent. at 18°, the minimum for *C. salicinum*, *F.* sp., *H.* sp., and *M.* sp., being 92·5 per cent., for *P. herbarum* and *M. leptospermi* 95 per cent., and for *Phycopsis* sp. and *A.* sp. 96 per cent.

In cool-temperate climates the evergreen substrata most conducive to growth of the Capnodiaceae are very scarce during the winter, their season of maximum development, a fact that may account for the restricted incidence of this group in such regions. On the other hand, the warm-temperate climates of Australia and the Mediterranean countries provide an abundance of perennial coniferous foliage on which the sooty moulds are able to establish themselves during the winter and so persist from one season to the next.

Mundkur (B. B.). **A contribution towards a knowledge of Indian Ustilaginales.**—*Trans. Brit. mycol. Soc.*, xxiii, 1, pp. 86–121, 2 figs., 1939.

The author states that the critical re-examination of 49 collections of Indian smuts in the Herbarium Cryptogamae Indiae Orientalis [details of which are included] resulted in their grouping into 25 species,

of which seven are considered to be new to science, and five appear as new combinations. Descriptions and Latin diagnoses are appended of the new species, among which is *Tilletia ajrekari* n.sp., found on a single grain of bulrush millet (*Pennisetum typhoides*) in experimental plots at Ahmedabad. The sorus completely destroys the ovary and protrudes prominently from the glumes; it is ellipsoidal, about 6 mm. long, slightly folded on itself and shrunk, and is enveloped with a black, thick, and firm membrane enclosing the spores which escape from a slit at the apex. The spores, 13·8 to 21 μ (mean 17·7 μ) in diameter, are pulverulent, mostly globose but occasionally aberrant; they are deep brown but not opaque, with an epispore 2 to 3 μ thick, bearing flattened, roughly rectangular, blunt spines very irregularly disposed. Their mode of germination is not known. This smut seems to be very rare, and in its sorus somewhat resembles *Tolyposporium penicillariae*, for which it may be mistaken.

An emended description is given of *U. eleusinis* [*R.A.M.*, ii, p. 309] on *Eleusine coracana*, in which it is stated that the spores have a rough and minutely pitted epispore, the pits having been evidently mistaken by Kulkarni for spines or echinulations. A smut on the same host collected by McDonald at Nairobi, Kenya, agrees very well with the Indian fungus, except that its spores have a wider range and a higher mean diameter: 8 to 14 (mean 10·4) μ as against 7 to 11 (mean 9·6) μ. Sydow's *U. eleusines* [ibid., ix, p. 342] is presumably a different species, but the specific name is not valid, having been already used by Kulkarni.

Shear (C. L.). **Mycological notes. III.**—*Mycologia*, xxxi, 3, pp. 322–336, 1 fig., 1939.

Discussing the results of studies on *Sphaeria gleditschiae*, the author arrives at the conclusion that this species is identical with *Sphaeropsis malorum* Peck (*Physalospora obtusa*) as already pointed out by N. E. Stevens [ibid., xiii, p. 312].

Sampson (Kathleen). **Life cycles of smut fungi.**—*Trans. Brit. mycol. Soc.*, xxiii, 1, pp. 1–23, 1939.

The author reviews in some detail the literature dealing with the life-history of the smut fungi as a group, with particular reference to the behaviour of the nuclei in the promycelium, and critically discusses the various assumptions in regard to the process of nuclear fusion in the formation of the chlamydospores, and to the parasitism of the haploid and diploid mycelia. The paper terminates with a brief consideration of biologic specialization in the smuts.

Keay (Margaret A.). **A study of certain species of the genus Sclerotinia.**—*Ann. appl. Biol.*, xxvi, 2, pp. 227–246, 1 pl., 1939.

A comparative study is reported on *Sclerotinia serica* [*R.A.M.*, xvi, p. 680], *S. sclerotiorum* (from swedes and hops), *S. trifoliorum* [ibid., xviii, p. 318] from clover, vetch, sainfoin (*Onobrychis viciaefolia*), and carrot, a strain of *S. trifoliorum* isolated in four localities in England from *Vicia faba* and given the varietal name *fabae* [without a Latin diagnosis], and a species referred to *S. minor* [ibid., xvii, p. 433] from

Helianthus tuberosus, a new record for Great Britain. On the basis of their pathogenicity, the species were classified in three groups, the first comprising *S. sclerotiorum* and *S. minor*, the second *S. trifoliorum* and its var. *fabae*, and the third *S. serica*. Ascospores of *S. sclerotiorum*, *S. minor*, and *S. trifoliorum* failed to infect various healthy test plants but produced infection on wounded or moribund tissues. The production of mycelium by sclerotia in the soil was not observed in any of the species. *S. serica*, but none of the other species, produced numerous apothecial stipes in cultures aged from six weeks to six months, and some mature apothecia when exposed to light. Sclerotia of *S. sclerotiorum*, *S. trifoliorum* and its var. *fabae* formed in cultures over a wide temperature range produced apothecia when subsequently buried in damp sand and were not influenced therein by different conditions of temperature and moisture. Apothecia developed from monospore lines of *S. minor*, *S. trifoliorum*, and *S. sclerotiorum*, but not from *S. trifoliorum* var. *fabae* and *S. serica*. Apothecia of *S. minor* arising from sclerotia formed on sterilized potato, carrot, or artichoke were larger than those from sclerotia formed on malt extract (average diameter 3·9 and 2·2 mm., respectively), so that the size of the apothecia should not serve as a diagnostic character. The shape and colour of the apothecia, on the other hand, were distinctive, those of *S. sclerotiorum* being light brown and somewhat trumpet-shaped, those of *S. minor* slender in the early stages and more tubular at maturity, the stalk being brown and the disk light buff, those of *S. trifoliorum* and its var. *fabae* tubular and darker than the others. The average size of the ascospores of *S. sclerotiorum*, *S. minor*, *S. trifoliorum*, *S. trifoliorum* var. *fabae*, and *S. serica* was 12·38 by 6·59 μ, 14·1 by 7·88 μ, 15·23 by 8·17 μ, 19·02 by 9·97 μ, and 20·65 by 10·12 μ, respectively, and the average size of the asci 125·7 by 10·15 μ, 149·8 by 12·42 μ, 180·1 by 13·55 μ, 193·98 by 16·41 μ, and 210·54 by 16·87 μ, respectively. The optimum temperature for the lateral growth of the mycelium was 20° C. for all species, except for *S. sclerotiorum* (in one experiment) and *S. minor*, where it was 25°. The time needed to reach a diameter of 6 cm. at 20° was 36·5 to 40, 36·5 to 47, 65·5 to 69, 59·5, and 103 hours, respectively, for *S. sclerotiorum*, *S. minor*, *S. trifoliorum*, *S. trifoliorum* var. *fabae*, and *S. serica*. *S. trifoliorum* var. *fabae* also differs from the normal species in its smaller sclerotia and absence of conspicuous haptera in culture. A variant of *S. trifoliorum* var. *fabae* with light brown sclerotia differed from its parent form in pathogenicity, temperature relations, and appearance in culture.

SCHOOREL (A. F.) & BOEDIJN (K. B.). **De steenroode wortelschimmel (Poria hypolateritia).** [The brick-red root fungus (*Poria hypolateritia*).]—*Arch. Theecult. Ned.-Ind.*, xii, 1, pp. 19–25, 3 figs., 1939. [English summary.]

In December, 1938, the fructifications of *Poria hypolateritia* were detected on tea bushes [*R.A.M.*, xvii, p. 705] in plantations at elevations between 1,000 and 5,000 m. above sea-level, mostly on clay-loam soils, to the south-west of Bandoeng and elsewhere in Java. This is stated to be the first authentic report of the fungus in the country, Petch's statement regarding its occurrence in Java in his 'Diseases of

the Tea Bush' [ibid., iii, p. 3] being based on a misconception. *P. hypolateritia* is not of great importance in Java, where the common red root rot of tea is caused by *Ganoderma pseudoferreum.*

GRAINGER (J.). **Temperature relations of Tobacco-mosaic virus and its host.**—*Phytopathology*, xxix, 5, pp. 441–448, 1 fig., 2 graphs, 1939.

Further evidence of the masking of tobacco mosaic symptoms at low temperatures (below 50° F.) in a greenhouse near Huddersfield, Yorkshire [*R.A.M.*, xv, p. 403] is presented. Though the virus is actually present in the symptomless foliage at masking temperatures, the first obvious signs of disease only appear at 65° and reach a climax between 70° and 85°, no difference in virus activity being apparent between these two temperatures. Under local greenhouse conditions the host (Connecticut Havana) is capable of growth between 32° and 108°, attaining its maximum activity at 70°. The temperature of optimal activity of the virus therefore is not wholly coincident with that of its host. Daily plottings of the growth rates of diseased tobacco plants at 85° and 70° show that, for a few days after inoculation, development tends to be delayed at the lower temperatures, though after ten days the reverse uniformly obtains. The virus moves at about the same rate at both temperatures.

LAUFFER (M. A.) & STANLEY (W. M.). **The physical chemistry of Tobacco mosaic virus protein.**—*Chem. Rev.*, xxiv, 2, pp. 303–321, 3 figs., 1 diag., 5 graphs, 1939.

This is a review of recent optical, ultracentrifugation, viscosity, diffusion, X-ray, and other physico-chemical studies in connexion with the shape and size of the tobacco mosaic virus protein particles, most of which have been noticed from time to time in this *Review*.

STANLEY (W. M.) & LAUFFER (M. A.). **Disintegration of Tobacco mosaic virus in urea solutions.**—*Science*, N.S., lxxxix, 2311, pp. 345–347, 1 graph, 1939.

Tobacco mosaic virus protein (10 mg. per c.c.) in 6 M urea and 0·1 M phosphate buffer at P_H 7 was shown to disintegrate into low molecular weight protein (a decrease in molecular weight from a figure of the order of several millions to one of about 100,000 after five days and about 40,000 after four weeks) which was free of nucleic acid and insoluble in dilute buffers. The disintegration was followed by the appearance of free sulphhydryl groups. The low molecular weight material was inactive, and the specific activity of the remaining high molecular weight material was from 10 to 50 per cent. that of ordinary virus protein. Following extensive disintegration practically all the protein was found in the supernatant liquid and only traces remained in the sediment. The disintegration did not appear to be readily reversible by the removal of urea. The rate of disintegration varied widely with the concentration of urea, the concentration and the type of electrolyte, the hydrogen-ion concentration, and the temperature.

Khudyna (I. P.). Серологический метод в применении к изучению вирусных заболеваний Табака. [The application of the serological method to the study of virus diseases of Tobacco.]—Всесоюзн. научноисслед. Инст. Табачн. Махорочн. Пром. им. А. И. Микояна (ВИТИМ) [*The A. I. Mikoyan pan-Soviet Sci. Res. Inst. Tob. and Indian Tob. Ind.* (*VITIM*)], *Krasnodar, Publ.* 137, pp. 13–30, 1939. [English summary.]

On the basis of the results of serological tests by the drop method recently described by Dounin and Popova [*R.A.M.*, xvii, p. 762] the author classifies 20 different types of virus diseases of tobacco in the U.S.S.R. [the symptoms of which are briefly described] into seven distinct groups, namely: (*a*) tobacco mosaics, (*b*) cucumber mosaics, (*c*) etch, (*d*) tobacco ring spot, (*e*) wet montar or stolbur [ibid., xvi, p. 49], which is believed to be probably identical with big bud [cf. ibid., xv, p. 406], (*f*) kroepoek or leaf curl [ibid., xviii, p. 481], and (*g*) crinkle dwarf. The method is further claimed to have been effective in demonstrating the complex nature of two diseases caused by mixtures of cucumber and tobacco mosaic viruses, and to have been successfully used in tobacco-breeding experiments by permitting the selection of virus-resistant forms among *Nicotiana glutinosa* × *N. tabacum* hybrids. In disease control work the method might be useful in the determination of the degree of infectiousness of post-harvest tobacco residues, the efficacy of disinfection of such residues, and the like.

Khudyna (I. P.). Борьба с табачной мозаикой в производственных условиях. [Control of Tobacco mosaic under practical agricultural conditions.]—Всесоюзн. научноисслед. Инст. Табачн. Махорочн. Пром. им. А. И. Микояна (ВИТИМ) [*The A. I. Mikoyan pan-Soviet Sci. Res. Inst. Tob. and Indian Tob. Ind.* (*VITIM*)], *Krasnodar, Publ.* 137, pp. 57–66, 1939. [English summary.]

The author states that the introduction in 1932 of special control measures in a number of important tobacco farms in the Caucasus has reduced the damage caused by common tobacco mosaic, probably the most widespread and dangerous virus disease of the crop, to one-third or even less. Briefly summarized these measures consist in the stringent disinfection and sanitation of the seed-beds and all planting material; the prohibition of smoking in the plantations; the careful roguing out and destruction by fire of all mosaic seedlings in the seed-beds on the day before planting out; the removal from the fields of all mosaic plants, together with their roots, by special teams avoiding contact with healthy plants; and the rotation of tobacco with other non-susceptible crops, preferably cereals. The soil of the vacated tobacco seed-beds should be kept in fallow during the whole of the following summer.

Hopkins (J. C. F.). **Diseases of Tobacco in Southern Rhodesia. (Supplement I. 1932 to 1938).**—*Rhod. agric. J.*, xxxvi, 2, pp. 97–119, 6 pl., 1 diag., 1939.

In this contribution to the supplement [*R.A.M.*, xviii, p. 483] of his book on tobacco diseases in Southern Rhodesia, the author gives notes

incorporating the results of recent work on the following diseases: mildew or white mould (*Erysiphe cichoracearum*) [ibid., xvii, p. 847], frog eye (*Cercospora nicotianae*) [ibid., xvii, p. 776], brown stem rot (*Phytophthora parasitica*) [ibid., x, p. 762], black stem rot (*Pythium aphanidermatum*) [ibid., xvii, p. 295], mosaic [ibid., xvii, p. 776], rosette [ibid., xviii, p. 347], leaf curl (formerly referred to as 'crinkle' in Southern Rhodesia) [ibid., xviii, p. 481], chlorine toxicity, frenching [ibid., xvii, pp. 560, 847], lightning injury, barn rot (*Rhizopus arrhizus*) [ibid., xvii, p. 844], and yellow mould (*Aspergillus flavus*) [loc. cit.].

SILBERSCHMIDT (K.) & KRAMER (M.). **Contribuição para o conhecimento do mosaico do Fumo e dos seus hospedeiros selvagens no Brasil.** [A contribution to the knowledge of Tobacco mosaic and of its wild hosts in Brazil.]—*Arq. Inst. biol. S. Paulo*, ix, 1, pp. 1–20, 4 pl., 1938. [German summary. Received July, 1939.]

Mosaic-diseased tobacco plants collected from various districts of São Paulo, Brazil, were found to fall into six categories in respect of their symptoms, viz., (1) coarse mosaic on the White Stem variety, characterized by coarse, well-defined, dark green spots on the leaves; (2) 'cabbage' form on the same variety, in which the edge of the leaf fails to reach the point of insertion of the petiole on the stem and the margins are crenate; (3) veinbanding on the Yellow variety, marked by dark lines parallel with the secondary and tertiary veins; (4) very mild mosaic of Virginia tobacco, characterized by pale green spots visible only by transparent light; (5) mild mosaic on White Stem, associated with spots and small lines of slightly darker green than normal, without blistering; and (6) papillate form, producing on Yellow a large number of protuberances arranged in rows along the secondary veins.

In inoculation experiments on *Nicotiana sylvestris* the juices of the coarse, 'cabbage', and veinbanding forms induced, after an incubation period of three weeks, well-marked mosaic symptoms accompanied in the case of the last-named by irregular necrosis of the leaf margins. The papillate strain causes chlorosis, followed by mild mosaic in the form of ring spot. Mild mosaic produces mosaic after a lengthy interval, whereas inoculation with very mild mosaic results only in systemic chlorosis and vein-clearing without foliar distortion. No symptoms developed in *Solanum* (?) *reflexum* plants inoculated with the papillate and very mild strains of tobacco mosaic, whereas the other four forms induced more or less identical mottling reactions, slightly differentiated perhaps in the case of veinbanding by a yellow mosaic of the young foliage. In a further series of inoculations on Scotia beans (*Phaseolus vulgaris*) with the six above-mentioned strains and two others, designated (7) pure S. Paulo mosaic, resembling the papillate form, and (8) Campinas mosaic, causing a fine blistering and sparse, indistinct marginal rings, the average numbers of lesions per leaf produced after a week by the mild, 'cabbage', coarse, very mild, papillate, veinbanding, S. Paulo, and Campinas strains were 4·66, 0·287, 4·70, 0·2, 3·79, 1·887, 1·55, and 0·165, respectively.

After ten minutes' heating of the juices from the various diseased plants at 90° C. the very mild mosaic strain was the only one capable of

attacking all four test plants inoculated, viz. beans, *N. glutinosa*, *N. sylvestris*, and Geudertheimer tobacco, producing necrotic lesions on the first two and systemic infection on the others. 'Cabbage' mosaic was pathogenic to all except beans, causing systemic infection of Geudertheimer and *N. sylvestris* and necrotic lesions on *N. glutinosa*. The coarse, papillate, and S. Paulo strains attacked *N. glutinosa* and Geudertheimer, the former reacting by necrotic lesions and the latter by systemic infection. Mild mosaic and veinbanding were pathogenic only to *N. glutinosa* (necrotic lesions), while the Campinas strain was totally inactivated by the treatment. In further inoculation tests with the two sharply differentiated strains, very mild mosaic and veinbanding, after ten minutes' heating at 60° and 90°, positive results were obtained on *N. rustica* var. *brasilia* with both strains five days after inoculation with juice heated at 60° and twelve days after inoculation with that heated at 90°, and on Rei Umberto tomatoes with very mild mosaic 21 days after inoculation with juice heated at 60° and with veinbanding after the same period following inoculation with juice heated at either temperature. The very mild mosaic strain produced typical mosaic symptoms (including filiform new leaves, partially or totally reduced to a petiole) on tomatoes, which reacted to veinbanding by the development of new leaves with a slightly crinkled surface and apical rolling of the margins. In inoculation tests with the juices of the very mild, papillate, Campinas, veinbanding, S. Paulo, and mild strains after ten minutes' heating at 80° the average numbers of lesions per leaf three days later on *N. glutinosa* were 3, 16, 17·6, 29, 40·6, and 53, respectively, the corresponding figures for *N. rustica* var. *brasilia* after eight days being 3·1, 15, 28·5, 24, 23·7, and 28·7, respectively.

It would appear from these data that all the eight strains under discussion are forms of common mosaic, of which at least three, however, differ among themselves in their virus concentration and reaction to heat, namely, veinbanding, mild mosaic, and very mild mosaic.

Inoculation experiments with the S. Paulo strain of tobacco mosaic on a number of wild Solanaceae growing in proximity to tobacco and potato fields gave positive results on *S.* (?) *reflexum*, *S.* (?) *platanifolium*, *S. aculeatissimum*, *S. mammosum*, *S. atropurpureum*, *S. sisymbrifolium*, and *S. nigrum* [details of the symptoms induced on each of which are furnished]. *S. variabile* appears to act as a carrier of the virus without showing any definite symptoms itself. These weeds should be eradicated from the vicinity of tobacco plantations.

Silberschmidt (K.) & Carvalho (J. C.). **Observações citologicas sobre o mosaico do Fumo.** [Cytological observations on Tobacco mosaic.] —*Arq. Inst. biol., S. Paulo*, ix, pp. 261–271, 5 figs., 1938. [German summary. Received July, 1939.]

In order to determine whether the cytological cell inclusions (X- and crystalline bodies) characteristic of tobacco mosaic are present in plants carrying the virus in a masked form without external symptoms, the writers carried out a comparative examination of the leaf trichomes of *Solanum aculeatissimum*, *S. atropurpureum*, *S. sisymbrifolium*, and *S. variabile*, all affected by the disease in São Paulo, Brazil [see preceding abstract]. The two first-named species, which develop the mosaic

symptoms in a severe form, were found to contain numerous inclusions; striate bodies occurred in 38·62 and 4·27 per cent., respectively, of the trichomes of the pale and dark green areas of *S. aculeatissimum*, the corresponding figures for *S. atropurpureum* being 39·56 and 8·59, respectively, whilst the percentages of X-bodies in the trichomes of the pale and dark green areas of *S. aculeatissimum* were 8·27 and 0·16, respectively, and in those of *S. atropurpureum* 15·66 and 0·88, respectively. The ratios of striate to X-bodies in *S. aculeatissimum* and *S. atropurpureum* were 4·66 : 1 and 2·52 : 1, respectively. *S. sisymbrifolium*, in which the symptoms are very mild, contained only striate bodies (4·37 per cent.), while *S. variabile*, a completely masked carrier of the virus, showed no inclusions of either kind. These observations point to a direct correlation between the presence of cell inclusions and the severity of the mosaic symptoms.

MATTHEWS (E. D.), RENEGER (C. A.), & THOMAS (R. P.). **Soil studies on the causes of the brown rot of Tobacco.**—*J. agric. Res.*, lviii, 9, pp. 673–684, 2 graphs, 1939.

In their investigations of the chemical and biological soil factors suspected of association with brown root rot of tobacco [*R.A.M.*, xviii, p. 64], the authors found that by plating out many of the infected tobacco roots and soils from Maryland they obtained, among others, pure cultures of *Rhizoctonia bataticola* [*Macrophomina phaseoli*], which were almost exclusively of the *Sclerotium* form of the organism, and for this reason are referred to as *S. bataticola* [ibid., xvii, p. 115]. Cultural studies showed that the fungus is readily killed by air-drying, decomposes cellulose, readily utilizes nitrate or organic forms of nitrogen, and grows better in neutral to alkaline media; these characteristics are apparently in accordance with the field conditions tending to favour the occurrence and severity of the root rot. It is further stated that the disease was reproduced by inoculation with *S. bataticola* in the greenhouse under controlled conditions. The authors conclude that previous explanations of the cause of brown root rot are fallacious and that *S. bataticola* can be responsible for the disease though it may not be the only fungus capable of causing it.

LEVYKH (P. M.). Влияние температуры, влажности и реакции почвы на развитие черной корневой гнили Табака. [Effect of soil temperature, moisture, and reaction on the development of Tobacco black root rot.]—Всесоюзн. научноисслед. Инст. Табачн. Махорочн. Пром. им. А. И. Микояна (ВИТИМ) [*The A. I. Mikoyan pan-Soviet sci. Res. Inst. Tob. and Indian Tob. Ind.* (*VITIM*)], *Krasnodar*, *Publ.* 137, pp. 3–12, 1939. [English summary.]

In continuation of his studies on black root rot of tobacco (*Thielaviopsis basicola*) [*R.A.M.*, xvii, p. 774] the author states that the results of greenhouse experiments [some details of which are given] showed that the incidence and intensity of the disease are not markedly affected by variations in constant soil moisture ranging from 30 to 80 per cent. of saturation, the main contributing factors in the development of the rot being soil reaction and temperature. The latter point was well supported by field experiments at Krasnodar, where under ordinary condi-

tions the disease usually fails to establish itself even in infected tobacco transplants, while on plots in which the soil temperature was reduced to 22·7° and 25·7° C. by mulching, up to 47 per cent. of the seedlings developed the disease. In pot experiments the optimum P_H value was between 6·4 and 7, the development of the rot being very poor at P_H 5·5 and 8·2. Laboratory tests indicated that the chlamydospores of *T. basicola* did not germinate at temperatures from 2·4° to 5° and from 39° to 40°, the optimum for germination lying between 28° and 30°; the optimum P_H value was 5·87, no germination ensuing at 3 and 12·89.

Grooshevoy (S. E.). Протравление корней рассады перед посадкой, как мера борьбы с болезнями Табака. [Disinfection of the roots of Tobacco transplants before replanting in the control of Tobacco diseases.]—Всесоюзн. научноисслед. Инст. Табачн. Махорочн. Пром. им. А. И. Микояна (ВИТИМ) [*The A. I. Mikoyan pan-Soviet sci. Res. Inst. Tob. and Indian Tob. Ind.* (*VITIM*)], *Krasnodar, Publ.* 137, pp. 31–39, 1939. [English summary.]

Details are given of experiments in 1937 in North Caucasus, the results of which showed that dipping of the roots of tobacco seedlings just before replanting in 1 per cent. Bordeaux mixture or in a mixture of 2 per cent. iron sulphate and milk of lime (in the proportion of 1 part iron sulphate to 1·2 parts unslaked lime) very considerably reduced the infection of the seedlings with mosaic, bacterial 'ryaboukha' [chiefly *Bacterium tabacum*: *R.A.M.*, xvii, p. 712], and black root rot [*Thielaviopsis basicola*: see preceding and next abstracts]. The treatment did not injuriously affect either the rooting or the subsequent growth of the tobacco plants, and in one series of experiments it increased the yield by from 6·3 to 26·7 per cent. While admittedly preliminary, these results are considered to warrant further trials on a wider scale.

Grooshevoy (S. E.). Использование солничной энергии для обеззараживания парниковой земли под стеклянными рамами. [Disinfection of seed-bed soil in cold frames by solar energy.]—Всесоюзн. научноисслед. Инст. Табачн. Махорочн. Пром. им. А. И. Микояна (ВИТИМ) [*The A. I. Mikoyan pan-Soviet sci. Res. Inst. Tob. and Indian Tob. Ind.* (*VITIM*)], *Krasnodar, Publ.* 137, pp. 51–56, 1939. [English summary.]

The author states that effective control of tobacco seedling diseases, including black root rot (*Thielaviopsis basicola*) [see preceding abstracts], was obtained in 1938 in the Caucasus, in experiments in which the seed-bed soil under cold frames had been subjected, prior to sowing, to direct sunlight for periods sufficient to raise the temperature of the top layer of the soil (to a depth of 10 cm.) to between 40° and 60° C. Subsidiary tests are further stated to have shown that *T. basicola* chlamydospores, the most heat-resistant of the tobacco seedling parasites, are completely killed by one six-hour exposure to 60° or two consecutive six-hour exposures to 50° to 55°; two similar exposures to 45° reduced the germinability of the chlamydospores from 15·7 to 0·7 per cent. Potted tobacco seedlings planted in soil taken from the top 5 cm. in the treated

cold frames developed 1 per cent., and those planted in soil taken from a depth of 5 to 10 cm. 4 per cent. black root rot, as against 65 per cent. in control seedlings. The duration of the treatment is dependent on the temperature to which the top layer is raised under the frames, and ranges from one day at 60° to seven days at 40°.

ORTH (H.). **Untersuchungen über die Biologie und Bekämpfung des Erregers der Stengelfäule der Tomate [Didymella lycopersici (Kleb.)].** [Studies on the biology and control of the agent of Tomato stem rot (*Didymella lycopersici* Kleb.).]—*Zbl. Bakt.*, Abt. 2, c, 9–13, pp. 211–244, 5 figs., 7 graphs, 1939.

A comprehensive, tabulated account is given of the writer's studies on tomato stem rot (*Didymella lycopersici*) at the Aschersleben branch of the Reich Biological Institute [*R.A.M.*, xviii, p. 508]. The perithecia and ascospores of the fungus were neither found on overwintered plant residues in the open, nor did they develop in culture on synthetic media maintained for lengthy periods at under 0° C., so that the pycnidial stage (*Ascochyta lycopersici*) [ibid., xvii, p. 506] is evidently the chief agent in the spread of infection. The disease occurs in two well-marked forms in the field, viz., primary infection of the stem bases through the soil, and secondary outbreaks, due to spore flights, on the leading shoot, petioles, and especially the leaf axils. The fruits are also commonly attacked by the fungus even in the lighter types of soil where the vegetative organs remain free from infection. The seed coat is permeated by the mycelium and covered with pycnidia, so that soil infestation and the consequent perpetuation of disease through the seed are possible. Old plants are normally more susceptible than young ones, the symptoms of stem rot seldom developing before transplanting to the open; however, when young plants have their cuticle and epidermis removed they are as liable to infection as more mature ones. Infected seed rarely gives rise to diseased plants, but an occasional reduction of germination has been observed.

On various agar media the optimum temperatures for mycelial development and pycnidial formation were 17° to 19° and 16° to 20° C.; at 31·8° growth was entirely inhibited. The thermal death point of the pycnospores was found to lie between 44° and 48° (continuous exposure for five minutes). Agar cultures of *D. lycopersici* buried in sand, in which, as observed above, stem rot seldom occurs, were destroyed by the natural heat of the soil, but prolonged subjection to cold (—20°) did not impair the viability of the fungus.

D. lycopersici grows on a number of agar media, while dilute decoctions of organic manure and samples from the infested black soil region also constitute suitable substrata. The fungus penetrates the soil to a depth of 5 cm. It is well adapted to a saprophytic mode of existence and its parasitism on tomato is purely facultative. Dense mycelial growth is produced by the organism in liquid media, especially with the addition of tomato extract. Twice-distilled water gave more consistent germination results than once-distilled or tap water, the two latter being improved in this respect, however, by the addition of tomato extract, which appears to exert a specifically stimulatory effect. The juice of *Solanum racemiflorum*, a semi-resistant wild form, gave a moderate

stimulus to spore germination, not to be compared with that resulting from the action of the cultivated varieties (Lucullus in these tests).

Notwithstanding the extreme sensitivity of the spores to fungicides, the chemical control of stem rot presents considerable difficulties, success in the open being achieved only by watering with 0·1 per cent. mercuric chloride and the application of 1 per cent. formaldehyde to the supports. In the greenhouse the death of infected plants was retarded by the stimulation of adventive root formation by the heaping-up of sterilized soil round the plants, while the treatment of the stem bases with 3 per cent. ceresan or uspulun loam emulsion gave good control in inoculation experiments. Another means of reducing the incidence of infection consists in the sparing use of stable manure.

None of the 108 cultivated varieties tested in the greenhouse and field gave evidence of immunity from *D. lycopersici*, and even the resistance of *S. racemigerum* [*Lycopersicum pimpinellifolium*] and *S. racemiflorum* under glass was not uniformly maintained during four years' growth in the open [ibid., xii, p. 477]. *S. nigrum* is seldom attacked by the stem rot fungus, the development of which on the shoots in inoculation tests was not followed by any sign of injury. Solanaceous weeds are thus probably of little importance in the dissemination of the disease, which is effected mainly by the movement of infested soil particles.

Hynes (H. J.). **Control of Tomato leaf mildew. Successful results in glasshouse tests.**—*Agric. Gaz. N.S.W.*, l, 5, pp. 244–247, 3 figs., 1939.

Highly encouraging results in the control of leaf mould (*Cladosporium fulvum*) [*R.A.M.*, xviii, pp. 352, 353] on Chinese Red tomatoes in glasshouses were obtained in experiments conducted in two localities in New South Wales in which the plants were given ten or twelve fortnightly applications of shirlan AG spray at the rate of 1 to 1½ lb. per 40 gals. of water, alternating with sulphur dusting. The total amounts of shirlan used were 3¼ lb. per house of 680 plants and 10½ lb. per house of 650. Untreated plants and those treated with six other preparations were heavily infected. Good, but somewhat less satisfactory results were obtained in a third locality following seven fortnightly applications of shirlan AG at the rate of 1½ lb. per 40 gals. of water.

Taken as a whole, the treatment extended the picking period by three to four weeks and considerably increased the yield, in most cases by 50 to 60 per cent. The net profits from the treatment (neglecting the cost of labour) approximated to £20 to £25 per standard house.

Pickel (D. B.). **A 'podridão estilar' do Tomate.** [The 'style rot' of Tomato.]—*Biologico*, v, 4, pp. 68–70, 1 fig., 1939.

Inoculation experiments with *Fusarium solani* and other fungi associated with style rot [blossom end rot] of tomatoes [*R.A.M.*, iii, p. 488; xvii, p. 297] having given negative results, the writer attributes the disorder, which has recently been observed in Brazil, to functional disequilibrium consequent on a sudden onset of dry weather during the period of fruit formation. A similar effect may be produced by drying winds. Control measures should include the selection of resistant varieties, the use of argillo-silicious or clay-humus soils, drainage to

counteract excessive humidity, replacement of stable manure or other nitrogenous products by phosphates, erection of wind-breaks, e.g., of *Crotalaria juncea*, and timely irrigation during dry spells.

WOLF (F. A.). **Leafspot of Ash and Phyllosticta viridis.**—*Mycologia*, xxxi, 3, pp. 258–266, 4 figs., 1939.

In a study on a leaf spot disease of ash in the Duke Forest, North Carolina, *Phyllosticta viridis* was identified as the causal fungus. The disease is known to occur on *Fraxinus americana* and on *F. pennsylvanica* and its variety *lanceolata*, and is presumably widely distributed east of the Rocky Mountains. It attacks trees of all ages, the black fructifications being found either in patches or uniformly distributed over the entire lower leaf surface. With the advancing season pale green spots, gradually increasing in size, develop, the necrotic area measuring 0·5 to 1·5 cm. across by the middle of September. Large trees may be defoliated four to six weeks before the killing frosts occur. The perithecial stage of the fungus, maturing by the middle of March, was identified as *Mycosphaerella fraxinicola*. An examination of stained sections of infected leaves showed that the fructifications of the fungus are borne in stromata, each containing one to three spermogonial and carpogonial locules. Spermatial formation is initiated near the centre of the locule and proceeds centrifugally, each cell liberating four spermatia from the apex of a sterigma. Perithecial development is initiated at the same time as that of the spermogonia. In each locule there are one to four septate carpogonia. Mature perithecia are spherical, with a short, ostiolar papilla, and vary in diameter from 75 to 100 μ; mature asci measure 40 to 50 by 10 to 12 μ and contain eight ascospores, which are hyaline, uniseptate (the basal cell being the smaller), usually biseriate, and measure 8 to 10 by 4 to 4·5 μ. *M. fraxinicola* germinated readily in cultures from ascospores or tissue, forming small greyish- to brownish-black colonies. The fungus was found capable of discharging its ascospores over an extended period (15th March to 1st July), infection being probably conveyed to the foliage by currents of air. The mycelium develops slowly and pathogenesis becomes evident only about the middle of August. No conidial stage has been found. The two stages of the fungus are genetically connected for the first time in this paper and an amended description is given.

WILKINS (W. H.). **Studies in the genus Ustulina with special reference to parasitism. IV. Conidia—germination and infection.**—*Trans. Brit. mycol. Soc.*, xxiii, 1, pp. 65–85, 1 fig., 6 graphs, 1939.

The measurement of 250 conidia of *Ustulina vulgaris* [*R.A.M.*, xviii, pp. 69, 356], collected from beech trees over a period of six months in each of three consecutive years, showed their average size to be 7·31±0·003 by 3·06±0·0001 μ. The age of the conidia did not significantly affect their germinative capacity. They germinated at temperatures ranging from 5° to about 30° C., with an optimum between 20° and 25°, and a lower thermal death point below 0°. Germination occurs most readily in liquids, but also to some extent in a saturated atmosphere. Observations indicated that in nature moisture is a vital factor in the

production of conidial fructifications, and that a well-distributed rainfall of at least 0·5 in. per week is essential. The conidia germinated best in starch medium and oatmeal, and Leonian's was the best synthetic medium for their germination. The P_H range for germination was approximately between 2 and 9, with an optimum between 5 and 6. Germination tests in extracts from green and seasoned wood of seven different species showed that the conidia germinated better in the former, though good results were generally obtained in all the extracts with the exception of seasoned oak. Penetration of the germ-tubes occurred in six of the woods tested, but not in oak. Inoculation experiments with conidia on young beech and lime trees (12 of each) were successful, but the examination of infected trees after five years showed that no decay developed. The results of the investigations are considered to indicate that the conidia of *U. vulgaris* are the most probable agents of tree infection in temperate climates.

SERVAZZI (O.). **Contributi alla patologia dei Pioppi. VI. Ricerche sulla così detta 'defogliazione primaverile dei Pioppi'.** [Contributions to the pathology of Poplars. VI. Researches on the so-called 'spring defoliation of Poplars'.]—*Boll. Lab. sper. R. Oss. Fitopat. Torino*, xv, 3–4, pp. 49–152, 18 pp., 11 graphs, 1938 (issued 1939). [French, German, and English summaries.]

In this exhaustive account of researches carried out in Italy from 1933 to 1938 inclusive into so-called spring defoliation [*R.A.M.*, xvii, p. 779] of the type of poplar known locally as Canadian poplar (though its exact identity is very doubtful), the author states that the diseased material almost constantly showed the presence of a species of *Pollaccia*, which he names *P. elegans* [with a Latin diagnosis] and to which he attributes the disease, though inoculation tests with the fungus gave only negative results. The fungus causes large triangular black spots on the leaves. *Venturia populina* [ibid., xv, p. 618] also occurred on diseased shoots, and was proved by cultural studies to be the perfect stage of *P. elegans*. Sphaeropsid G. 2191 [ibid., xvii, p. 779], reported by other workers as associated with spring defoliation, is only saprophytic, or at most a weak parasite.

Under the conditions prevailing in Piedmont, the disease appears when the minimum temperature approximates to 10° C. and becomes more intense when the daily temperature lies between 10° and 25°; rainfall and atmospheric humidity are only secondary factors.

P. elegans also occurs on the pyramidal poplar (*Populus nigra* var. *italica*) and to a limited extent on other species of the section *Aigeiros* Duby of the genus *Populus*, e.g., *P. nigra* and the so-called Carolina poplar; on this last it produced a condition closely resembling 'spring defoliation'.

The differential characters of *P. elegans* and *P. radiosa* [*V. tremulae*: loc. cit.] are tabulated. The former has mostly biseptate conidia which measure over 30 by 10 (average 35 to 37 by 10 to 11) μ. In culture the maximum, minimum, and optimum temperatures for germination are, respectively, about 25°, below 10°, and about 15°, the corresponding growth temperatures being about 25°, below 10°, and between 15° and 20°. The colonies are felt-like, olive- or grey-green, compact, and

stromatic. 'Conidioid' hyphae, conidia, perithecia (*V. populina*) and pseudosclerotia are produced. The fungus does not grow in liquid media, or in media containing only saligenetic glucosides as a source of carbon. The perithecia have no or few appendages, and the ascospores average 20 by 10 μ.

Elm disease.—*Quart. J. For.*, xxxiii, 2, pp. 112–113, 1939.

According to a report received by the Forestry Commission, elm disease [*Ceratostomella ulmi*: *R.A.M.*, xviii, p. 558] appears to have received a check in England, where fewer trees, especially in eastern districts and the Midlands, show active signs of infection. It is thought, however, that this situation is only temporary, inasmuch as a similar check occurred in 1932, after which progress was resumed. The Jersey elm (*Ulmus stricta wheatleyi*) is stated to be more resistant than other varieties commonly grown in England. The disease does not appear to be present in Scotland, though *C. ulmi* was found there in a dead log in the present year.

Ruszkowski (J.). **Poland : organization of the Plant Protection Service.**—*Int. Bull. Pl. Prot.*, xiii, 5, pp. 108–109, 1939.

A brief outline is given of the organization of the Plant Protection Service in Poland, where 13 stations, attached to the Chambers of Agriculture and maintained and controlled by the Ministry of Agriculture and Agrarian Reform, work in close collaboration with agricultural and horticultural experiment stations, seed-testing stations, and schools of agriculture.

St. Lucia. Statutory Rules and Orders, 1939. No. 13. 29th April, 1939.—2 pp., 1939.

This proclamation by the Governor prohibits, except under licence, the importation into St. Lucia of banana plants and parts thereof, as a precaution against the introduction of *Cercospora* [*musae*: *R.A.M.*, xviii, p. 560].

Proclamation No. 4 of 1939.—*Nyasald Govt Not.* 18, 1 p., 1939. [Mimeographed.]

Proclamation No. 4 of 1939 (made under the Nyasaland Plant Pests and Diseases Ordinance [cf. 1924, *R.A.M.*, iv, p. 255]) prohibits the importation or introduction into Nyasaland of all citrus trees, plants, budwood, seeds, and dried peel, including candied peel, grown or produced in the territory administered by the Companhia de Mozambique, as well as fresh citrus fruits grown in the Beira, Neves Ferreira, Busi, and Cheringoma Districts of the same territory. The introduction into Nyasaland of fresh citrus fruits grown in other districts of the said territory is permitted provided their place of origin is certified.

As regards the territory administered by the Companhia de Mozambique, this proclamation repeals Proclamation No. 11 of 1936 [*R.A.M.*, xvi, p. 80], in so far as the latter relates to fresh citrus and dried citrus peel.

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Dutch Elm disease in the United States, 1930 to 1938.—*Plant Dis. Reptr*, xxiii, 6, p. 92, 2 maps, 1939. [Mimeographed.]

The maps accompanying this brief note show the areas in which elms infected by *Ceratostomella ulmi* have been found since the detection of the Dutch disease in the United States in 1930 (*a*) in the country as a whole, and (*b*) in the area surrounding New York Harbour [*R.A.M.*, xviii, p. 282].

MARCHAL (É.) & MAYNÉ (R.). **État actuel de l'étude de la maladie de l'Orme.** [Present state of the study of the Elm disease.]—*Bull. Soc. for. Belg.*, xlvi, 5–6, pp. 193–202, 1939.

In this paper (a report of the Commission Spéciale du Conseil Supérieur des Forêts de Belgique, dated 29th April, 1938) the authors, after briefly reviewing the geographical distribution and etiology of Dutch elm disease (*Ceratostomella ulmi*) [see preceding abstract] and expressing the view that the disease may possibly be transmitted by *Pteleobius* [*Hylesinus*] *vittatus* and *P.* [*H.*] *kraatzi*, discuss the question of control. The disease is too widespread in Belgium for eradication to be practicable, and the cost of fungicidal treatment by root absorption or injections appears to be prohibitive. The best method of control would appear to be the use of resistant varieties. In Belgium, *Ulmus foliacea fastigiata* (*dampierii*) has so far remained unaffected, while *U. stricta* (*cornubiensis*) is also recommended. Propagation should be effected by layering or by grafting on a very resistant variety.

BURNS (M. M.) & TAYLOR (N. H.). **A survey of Tung groves in New Zealand.**—*Bull. N.Z. Dep. sci. industr. Res.* 66, 61 pp., 16 figs., 1 graph, 1 map, 1939.

This bulletin contains notes on two diseases of tung oil trees (*Aleurites fordii*) in New Zealand, viz., 'puffy bark' and root rot.

'Puffy bark' is the name applied to a condition in which the tissues external to the wood of the main branches or trunk become swollen and pulpy and finally split away from the wood. In the incipient stage the epidermal layers are cracked, dried, and shrunken, chiefly as a result of exposure to strong, cold winds and growth on poorly drained soils. This phase, if not corrected by appropriate stimulatory measures, is followed by the swelling (to several times their normal thickness) and vertical splitting of the tissues between the wood and the bark.

Consequent on this abnormal growth of the phloem and cortex, the transport of nutrients to the upper portion of the tree is arrested and die-back ensues. The 'puffing-up' and splitting of the cortical layers usually proceeds downwards, and may kill the tree to within a few inches of ground-level. Trees thus affected often produce small secondary or 'feather-leg' shoots on the trunk below the diseased site. The best temporary remedy for this phase of the trouble is the removal of the branch at a distance of about 6 in. below the lowest affected point. 'Puffy bark' is generally most severe on the submature and mature podsols, mature granular clays, and hillside meadow soils of the Awarua complex. Of special interest during the recent survey of the tung groves was the occurrence of severe cases of the disease on the low-lying sections of the small fertile terrace on the banks of the Parapara Stream. Wherever the water-table was near the surface all the trees were affected and many had died, but where it was deeper only some of the largest had suffered.

A close association was observed between 'puffy bark' of the aerial system and root rots (taken collectively), the most severe losses (up to nearly 100 per cent.) from which were recorded on areas of heavy, poorly drained soils manured with blood-and-bone fertilizer round the roots of transplanted stocks.

Forest research in India, 1937–38. Part II. Provincial reports.—151 pp., 1939.

The following items of phytopathological interest occur on pp. 96–98 of this report. Observations by K. D. Bagchee indicated that unsoundness of sal (*Shorea robusta*) in the Singhbhum forests of Saranda, Bihar, is most prevalent (up to 75 per cent.) on white shale soils with an abundant cover of sabai grass (*Pollinidium angustifolium*) and least in evidence on red lateritic or iron ore slopes. The two fungi associated with unsoundness are *Fomes tricolor* [*R.A.M.*, xvii, p. 278] and *Trametes incerta*, both causing heart rot and the latter probably being responsible for the crooked appearance and knotty protrusions characteristic of affected trees. Mortality frequently occurs in mature stands of vigorous trees on dead red loam soils and is chiefly due to *Polyporus shoreae* [loc. cit.], which gains ingress through the roots and travels slowly up the stem.

Baxter (D. V.) & Wadsworth (F. H.). **Forests and fungus succession in the Lower Yukon Valley.**—*Bull. Sch. For. Mich.* 9, 52 pp., 9 pl., 3 diags., 1939.

The alluvial-flat forests of the lower Yukon meander belt, undisturbed by fire or axe, afford possibilities for the study of the natural time factor of disease incidence from the pioneer to the climax stages. *Melampsora bigelowii*, for instance, is chiefly injurious to willow (*Salix alaxensis*, *S. pulchra*, and *S. arbusculoides*) [*R.A.M.*, viii, p. 90] seedlings up to two years old, being of little importance in older stands, which are liable to infection by *Valsa salicina*, *V. sordida* [*Cytospora chrysosperma*: ibid., x, p. 418; xvii, p. 567], *F. igniarius* and its var. *nigricans* [*F. igniarius*: ibid., xvi, p. 715], *Poria ferruginosa*, *Trametes suaveolens*

[ibid., xi, p. 811], *Favolus canadensis*, *Pholiota adiposa* [ibid., xvi, p. 716], *Cytidia flocculenta*, and *Steccherinum ochraceum*. Willows are dominant for 45 to 50 years, after which they are gradually eliminated by fungous cankers, heart rot, and other adverse factors, to be replaced by spruce (*Picea glauca* and *P. mariana*) and an admixture of birch (*Betula alaskana* and *B. kenaica*), this succession (from the time of bar formation to the climax forest) occupying some 175 years. At this stage *Fomes pini* [ibid., xviii, p. 559] and *F. igniarius nigricans* are prevalent and very destructive on spruce and birch, respectively, with the addition of rusts and their alternate hosts not found in other communities, e.g., *Melampsoropsis* [*Chrysomyxa*] *ledicola* (*Peridermium decolorans*) on spruce needles [ibid., xv, p. 259] and *Ledum groenlandicum* and *L. decumbens*, *C. pyrolae* on *Pyrola* spp. [ibid., xvii, p. 618; xviii, p. 59], *C. cassandrae* on *Chamaedaphne*, *Peridermium coloradense* forming brooms on *Picea mariana* [ibid., xv, p. 794], and *Pucciniastrum myrtilli* [ibid., xv, p. 510] on *Vaccinium*.

The bearing of the ecological conditions of the forests under observation on the presence of some fungi and the absence of others, notably *Polyporus schweinitzii*, is fully discussed.

A list of other fungi recorded in the region is furnished.

Hearman (J.). **Minor elements and the Pine.**—*Aust. For.*, iii, pp. 24–27, 1938. [Abs. in *For. Abstr.*, i, 1, p. 22, 1939.]

A marked improvement in the condition of *Pinus radiata* affected by a rosette-forming disorder in Western Australia was secured by treatment with zinc chloride, while a certain stimulus to growth was also given by manganese and ferrous sulphates, cobalt and nickel chlorides, sodium molybdenate, and boracic acid, accompanied in some cases, however, by injurious effects, especially from the nickel, cobalt, and copper salts. Protracted observations on the local stands indicate that the rosette disturbance is not due to actual soil deficiency but to inability of the trees to assimilate the elements under the prevailing conditions.

Waterman (Alma M.). **The disease of Pines caused by Sphaeropsis ellisii.**—*Plant Dis. Reptr*, xxiii, 6, pp. 93–95, 1939. [Mimeographed.]

The pine disease caused by *Sphaeropsis ellisii* (*Diplodia pinea*) has been found to be widely distributed in the eastern and middle-western sections of the United States [*R.A.M.*, xvii, p. 573], the most susceptible species being the Austrian pine (*Pinus nigra*) [var. *austriaca*], followed (in the order named) by *P. sylvestris*, *P. resinosa*, *P. montana*, *P. ponderosa*, *P. strobus*, and *P. virginiana*. The fungus has also been observed in one instance on *Pseudotsuga taxifolia* [ibid., xvi, p. 75] and *Picea pungens* growing in proximity to heavily infected Austrian pines, on older specimens of which the progress of the disease is relatively slow, infection gradually working upwards from the lower branches. Cross-inoculation tests with the Austrian pine strain of *D. pinea* gave positive results on *P. sylvestris*, *P. resinosa*, and *P. ponderosa*. Effective control has been obtained in ornamental plantings by three to four applications of 4–4–50 Bordeaux with a soap spreader.

KLEBAHN (H.). **Untersuchungen über Cronartium gentianeum v. Thümen.** [Studies on *Cronartium gentianeum* v. Thümen.]—*Ber. dtsch. bot. Ges.*, lvii, 2, pp. 92–98, 1939.

The positive results of cross-inoculation experiments (in collaboration with Adolfine Buschmann) conclusively demonstrated the genetic connexion between a *Peridermium* on Scots pine (*Pinus sylvestris*) and *Cronartium gentianeum* on *Gentiana asclepiadea* in the Graz district of the Ostmark (formerly Austria) [*R.A.M.*, xviii, p. 73]. On the other hand, the relationship between *C. gentianeum* and *C. asclepiadeum* [loc. cit.] on *Vincetoxicum officinale* is not clear. The evidence at present available points to their identity, the physiologic races on *G. asclepiadea* and *V. officinale* being specialized on their own hosts, but further investigations are necessary definitely to confirm this hypothesis.

BARRETT (J.). **Timber salvage from Douglas Fir trees infected with conk rot (Trametes pini).**—*J. For.*, xxxvii, 7, pp. 577–578, 1939.

The writer examined a Douglas fir [*Pseudotsuga taxifolia*] stand in the north-western United States to determine the profitability or otherwise of timber salvage from trees infected by conk rot (*Trametes* [*Fomes*] *pini*) [*R.A.M.*, xv, p. 694]. Of the 1,057,376 ft. cut during the course of the inspection, 386,112 (38 per cent.) were diseased. The calculations made on the basis of a 25 per cent. total loss in the conversion of net scale on the ground to commercial log scale in the pond denote that heavily infected trees, i.e., those on which conks appear within 20 to 30 ft. from the ground and continue up to the top, should not be cut. Good footage, on the other hand, may be expected from slightly infected trees.

SOKOLOFF (D. V.). **The toxic action of hydrogen sulfide on certain molds and tree pathogenic fungi.**—*Mitt. forsttech. Akad. Kirov* (*U.S.S.R.*), li, pp. 70–77, 1938. [Abs. in *Chem. Abstr.*, xxxiii, 13, p. 5028, 1939.]

Solutions of hydrogen sulphide at concentrations of 5 to 14 per cent., with periods of exposure from one to six hours, proved lethal to *Merulius lacrymans*, *Coniophora cerebella* [*C. puteana*], *Poria vaillantii* [*R.A.M.*, xviii, p. 362], and *Fusarium avenaceum* in experiments in the U.S.S.R. The viability of pine seedlings did not suffer from short exposures to 3 to 4 per cent. solutions. Penetration to a depth of 1·5 cm. results from six hours' contact of the wood with 10 per cent. hydrogen sulphide.

FREYFELD (E. E.). Влияние влажности на произрастание в древесине дереворазрушающих грибов. [The effect of humidity on the growth of wood-destroying fungi in timber.]—*Sovetsk. Bot.*, *1939*, 1, pp. 99–103, 4 figs., 1939.

In experiments with *Poria vaporaria* [*R.A.M.*, xviii, p. 493] dry blocks of infected timber containing viable mycelium were suspended in wide-necked bottles with different degrees of relative humidity. At relative humidities of 100, 96, 94·8, and 94·2 per cent. saturation, the mycelium appeared on the outside of the blocks after 3, 4 to 5, 5 to 6, and 6 to 7 days, respectively, and the water contents of the blocks at the time of the appearance of the mycelium were 30 to 32, 27·8 to 29, 26·9 to 27·8, and 26 to 27 per cent., respectively. At 93·6 per cent.

relative humidity the water content of the blocks reached 25 per cent., but no mycelial growth was observed. When blocks of healthy dry timber were suspended in bottles some distance above blocks with well-developed mycelium or pure cultures of *P. vaporaria* the hyphae invariably grew towards the healthy timber in whatever direction it was placed, and spread over it, the water content of the healthy block having by then risen to between 30 and 31 per cent. In a relative humidity of 96 per cent. the mycelium spread from the diseased to healthy timber when the water content of the latter had reached 28 per cent., but attempts to induce infection on timber with a lower water content proved unsuccessful. It is concluded from these results that the minimum water content for the growth of the mycelium of *P. vaporaria* in infected timber is 26 per cent., and that healthy timber can be infected by *P. vaporaria* when its water content in 96 per cent. relative humidity is not lower than 28 per cent.

MOURASHKINSKY (K. E.). Окрашивание иодом при распознавании трутовиков. [Iodine staining as a means of differentiation of tinder fungi.]—*Bull. Soc. Nat. Moscou*, Sect. biol., N.S., xlvii, 4, pp. 261–265, 1938. [French summary. Received July, 1939.]

Both *Ungulina lapponica* [*Polyporus lapponicus*], and the later-described *U. ursina* [*P. ursinus*] showed the same colour reaction when stained with iodine and are considered to be identical. Their hyphal tramae became light or dark blue and the hyphal contents yellow, the most intense colouring being shown by the characteristic cystidia, for which the name amyloid cystidia is proposed. Negative reactions were obtained with *Leptoporus* [*Polyporus*] *erubescens* and the majority of other tinder fungi tested, with the exception of the group included in *Poria calcea*, most of which showed the light or dark blue colouring at the base of fruiting bodies or in isolated hyphae (or parts of them) as well as in the hyphal contents, older fruiting bodies showing the colour reaction more readily than immature ones. In *Ganoderma lucidum* and *Ungulina fomentaria* [*Fomes fomentarius*] the hyphae of the cuticle developed a light blue colouring. It is believed that colour reactions, and among them those obtained by iodine, should prove very useful in the differentiation of species of tinder fungi.

GIBBS (J. G.). **Factors influencing the control of club-root (Plasmodiophora brassicae).**—*N.Z. J. Sci. Tech.*, xx A, 6, pp. 409–412, 1 fig., 1 diag., 1939.

In the absence of a host, some spores of *Plasmodiophora brassicae* survived in the soil for a period of five years in the Palmerston North district of New Zealand [*R.A.M.*, xiv, p. 732], and in the sixth caused slight infection of Majestic swedes. No club root developed, however, in cabbages planted in the seventh year after the removal of the original diseased crop (rape [*Brassica napus* var. *oleifera*]). The longevity of the spores in the soil did not appear to be influenced by the use of infected ground for grazing, rotational cropping, haying, or treatment with carbonate of lime or sulphur (1 to 5 tons and 3 cwt. per acre, respectively).

Greenhill (A. W.). **The effect of boron on the growth and quality of Sugar Beet.**—*Ann. appl. Biol.*, xxvi, 2, pp. 392–396, 1939.

In this paper, read at the Annual Meeting of the Association of Applied Biologists held in London in 1939, the author sums up the present knowledge on the heart rot disease of sugar beet.

Stirrup (H. H.). **Sugar Beet diseases.**—*Ann. appl. Biol.*, xxvi, 2, pp. 402–404, 1939.

In this paper, read at the Annual Meeting of the Association of Applied Biologists held in London in 1939, it is stated that the term black leg [*R.A.M.*, viii, p. 629] covers several troubles of sugar beet seedlings, namely true black leg, insect injury, injury associated with soil acidity, and wind damage. True black leg, caused by *Phoma betae* and species of *Pythium* and *Rhizoctonia*, is favoured by poor tilth in the seed-bed, low soil temperature, lack of moisture, and cold winds. Seed treatment with a mercury disinfectant has been found to confer a certain degree of control, besides increasing the incidence of seedling emergence, but when conditions are favourable for growth little or no benefit accrues. Injury due to soil acidity can be either confined to the radicle and young lateral leaves, in which case the root system becomes tough and string-like, this type being provisionally named stringy root, or it affects the hypocotyl, which remains thin and tough with a brown and scurfy surface, this type being provisionally named stringy hypocotyl. Various fungi, chiefly *Fusarium* spp., isolated from roots and hypocotyls of such seedlings, are believed to be secondary invaders. Acid soil injury and wind damage, which latter may affect hypocotyls, cotyledons, or true leaves, are believed to be two of the primary causes of strangle disease [ibid., xv, p. 764], which originates in the seedling stage as some form of internal injury to the hypocotyl near soil level, forming a constriction in this region and causing the plants to break off at the strangled region. Most of the other diseases of sugar beet described in this paper have been noticed from previous papers of this author [ibid., xiv, p. 548; xviii, p. 226]. The various root rots mentioned include the black, shiny rot caused by *Phoma betae* on a root not affected with heart rot; wet rot caused by *Phytophthora megasperma* occurring only on heavy, wet soils; and internal zoned rot, a disease considered to be physiological in nature, characterized by well-defined necrotic zones in the internal tissues of the root. [A popular account of the seedling diseases of beet is given by the author in *Brit. Sug. Beet. Rev.*, xiii, 1, pp. 9–10, 3 figs., 1939.]

Pozhar (Z. A.). Влияние температуры на продолжительность инкубационного периода церкоспороза Сахарной Свеклы. [The effect of temperature on the length of the incubation period of *Cercospora beticola* on Sugar Beet.]—*Научн. Зап. по Сахарн. Пром.* [*Sci. Notes Sug. Ind.*], *Kieff*, [Grey Ser.], xv, 3–4, pp. 198–203, 1938. [Received July, 1939.]

The results of field inoculation experiments carried out in 1936 and 1937 by the Pan-Soviet Scientific Research Institute of Sugar Industry showed that the incubation period of *Cercospora beticola* on beet

[*R.A.M.*, xviii, p. 365] varied from 7 to 57 days (usually 10 to 13) according to the temperature. The shortest incubation period occurred at an average temperature of 19° C., the maximum temperature during this period being 25°, and the minimum 10°. The incubation period was lengthened by the rise or fall of the maximum and minimum temperature to above 25° or below 15°. It is suggested that the dates of spraying should be adjusted to coincide with the ends of the incubation periods calculated from temperature records which should be taken after the appearance of the first leaf spots. A table is presented in which the length of incubation periods is tentatively calculated from varying average, maximum, and minimum daily temperatures. Three or four spray applications a year are recommended.

Salunskaya (Mme N. I.). Химические меры борьбы с церкоспорозом Сахарной Свеклы. [Chemical methods of control of *Cercospora beticola* on Sugar Beet.]—*Научн. Зап. по Сахарн. Пром.* [*Sci. Notes Sug. Ind.*], *Kieff*, [Grey Ser.], xv, 3–4, pp. 204–218, 4 figs., 1938. [Received July, 1939.]

The information presented in this paper has already been noticed from another source [*R.A.M.*, xvii, p. 367].

Storey (I. F.). **Experiments and observations on a virus disease of winter Spinach (Spinacia oleracea).**—*Ann. appl. Biol.*, xxvi, 2, pp. 298–308, 1 pl., 1939.

A virus disease of spinach observed in 1936 at Slough, and found to be common in the Thames valley is described. The first symptom in the field is a yellowing of the younger leaves, which later spreads to the outer leaves, the plant becoming stunted, the younger leaves distorted, and the outer leaves limp till they lie on the ground. The older tissue disintegrates, the rotting spreads to the inner leaves and finally to the root, and the plant dies. In the field death occurs 50 to 64 days after the appearance of the first symptoms; in artificially infected plants the first symptoms appeared about 20 to 30 days after inoculation, and death occurred within from 80 to 96 days. The virus was successfully inoculated by means of sap from diseased plants into spinach, cucumber, tobacco, and *Nicotiana glutinosa*, but no infection occurred on tomato. On the basis of inoculation studies the virus under investigation is considered to be identical with cucumber virus 1, and the disease is thought probably to be the same as that recorded from America by McClintock and Smith (*J. agric. Res.*, xiv, p. 1, 1918).

Field counts on three farms in 1937–8 showed the losses due to the disease to be 19, 13, and 40 to 50 per cent. of the total stands, respectively. Early sowing (4th August) was followed by a greater incidence of disease and a higher degree of aphis infestation than later sowing (18th August and 1st September). Seeds from healthy and artificially infected plants showed 85 and 10 per cent. germination, respectively, and seeds from healthy and naturally diseased plants 90 and 15 per cent., respectively. No evidence of seed transmission has as yet been obtained. Vegetable marrows and summer spinach were also found to be infected by cucumber virus 1 and are probably the chief sources of infection in

the autumn. Their removal from the vicinity of spinach plantings is therefore advocated for the control of the disease, as well as sowing as late as the second half of September. The disease is easily transmissible by mechanical means, and care should be taken by workers not to spread infection on their hands.

CHAMBERLAIN (E. E.). **Pea-streak (Pisum virus 3).**—*N.Z. J. Sci. Tech.*, xx A, 6, pp. 365–381, 7 figs., 1939.

Since 1932 a streak disease of peas, apparently distinct from the disorders described under the same name from other countries, has been observed in the Palmerston North district of New Zealand, where it causes purple or purplish-brown markings on the leaves and pods and a dark discoloration of the stems, followed by cessation of growth and ultimately by the death of the plants. In the field the disease, for which the name of *Pisum* virus 3 is proposed, occurs only on garden peas; in experimental variety trials it has been responsible for heavy losses, especially in Day's Early Surprise, Hundredfold, Senator, Admiral Beatty, Gradus, Great Crop, and Laxton's Progress, a high degree of resistance being shown by Benefactor, Pride of the Market, Little Marvel, Wm. Massey, Autocrat, and the field peas Unica and White Ivory. Pea streak is readily transmissible by juice inoculations but not by aphids. Nineteen out of 52 species of Leguminosae and Cucurbitaceae tested for their reaction to the virus were found to be susceptible, namely, blue and yellow lupins (*Lupinus angustifolius* and *L. luteus*), *L. mutabilis*, beans (*Phaseolus vulgaris*), soy-beans, sweet peas, hairy vetch (*Vicia villosa*), *Galega officinalis*, red, white, alsike, cluster, nodding, and strawberry clovers (*Trifolium pratense*, *T. repens*, *T. hybridum*, *T. glomeratum*, *T. cernuum*, and *T. fragiferum*), hare's-foot trefoil (*T. arvense*), *Lotus hispidus*, cucumbers, vegetable marrows, and rock melons (*Cucumis melo* var. *cantalupensis*). The symptoms of the disease on the experimental hosts are briefly described.

The longevity of *Pisum* virus 3 was found to extend over a period of 41 days *in vitro*; its dilution end point is 1 in 1,000,000, its thermal death point 78° to 80°, and it is capable of traversing a 'fine' grade Mandler filter.

Control measures should be based on the use of resistant varieties, roguing and destruction of infected plants, and care to avoid spread through handling.

CHAMBERLAIN (E. E.). **Bean-mosaic. (Phaseolus virus 1 of Smith, 1937.)**—*N.Z. J. Sci. Tech.*, xx A, 6, pp. 381–388, 4 figs., 1939.

An account is given of bean mosaic (*Phaseolus* virus 1) [*R.A.M.*, xviii, p. 430], which has been observed in the Plant Research Station Area, Palmerston North, New Zealand, since 1933, affecting both *P. vulgaris* and *P. multiflorus*. The disease is of economic importance only on the popular Canadian Wonder variety, but Case-knife (runner) is also susceptible. Under local conditions infection is transmitted through the seed of both these varieties. Control measures involving the production of mosaic-free lines and breeding of resistant varieties are recommended.

Yu (T. F.). **Mild-mosaic virus of Broad Bean.**—*Phytopathology*, xxix, 5, pp. 448–455, 1 fig., 1939.

From April to June, 1934, broad beans (*Vicia faba*) in different parts of Kiangsu and Chekiang Provinces, China, were affected by a hitherto apparently undescribed virus disease, characterized by a mild, diffuse type of mottling and slight elongation of the leaves, without vein-banding, crinkling or rolling, curvature of the midrib, necrotic spotting, stunting, or distortion. The disorder is less prevalent than common mosaic [*R.A.M.*, xviii, p. 224].

In transmission experiments with the bean aphid (*Aphis rumicis*) the mild mosaic virus was pathogenic to its own host, lucerne, red, white, and white sweet clovers (*Trifolium pratense*, *T. repens*, and *Melilotus alba*), spring and winter vetches (*V. sativa* and *V. villosa*), *V. tetrasperma*, sweet peas, and field peas. It was conveyed by artificial juice inoculations, using carborundum as an abrasive, from broad bean to the three clovers, three vetches, and sweet peas. In lucerne, clovers, and peas the symptoms (which did not include foliar elongation) appear 14 to 27 days after colonization by bean aphids, 8 to 18 days being the usual period for the vetches; rolling and rugosity of the lower leaflets are features of infection in the latter.

The mild mosaic virus was found to resist ageing *in vitro* for three hours at 22° to 24° C., its inactivation temperature and tolerance of dilution being 55° to 60° and 1 in 1,500, respectively.

Hülsenberg (H.). **Zur Frage der Spargelrostbekämpfung mit kupferhaltigen Spritzbrühen.** [On the question of Asparagus rust control with copper-containing sprays.]—*Nachr. SchädlBekämpf., Leverkusen*, xiv, 2, pp. 65–72, 4 figs., 1939. [English, French, and Spanish summaries on pp. 93, 97, 100.]

Discussing the conflicting results hitherto obtained in Germany in the control of asparagus rust (*Puccinia asparagi*) with copper-containing sprays [*R.A.M.*, xviii, p. 292], the writer briefly summarizes the data from experiments in the Giessen district with Bayer neu plus a sticker or wetter, the most effective of which was preparation 2002 (I. G. Farben), followed by X and 2040, while Y was unsatisfactory. The percentages of plants in the (*a*) 0 to 2·5 and (*b*) 3 to 3·5 and (*c*) 4 to 5 classes (0 being free from infection and 5 very severely diseased) were as follows: (*a*) sprayed with Bayer neu plus 2002, X, 2040, and Y, 27·68, 23·74, 18·91, and 8·10, respectively, untreated 1·33; (*b*) 40·85, 26·83, 28·60, 25·47, and 5·18; and (*c*) 31·45, 46·22, 52·65, 59·48, and 92·86, respectively. It is concluded that effective control may be secured by the treatment of young plantings a fortnight before the expected appearance of the aecidia, with two subsequent applications; by treatment ten days after thinning-out and one or two further sprays at three-weekly intervals; and by three treatments for three-year-old plantings.

Ainsworth (G. C.) & Ogilvie (L.). **Lettuce mosaic.**—*Ann. appl. Biol.*, xxvi, 2, pp. 279–297, 2 pl., 1939.

This is an expanded account of investigations of which progress reports have been previously noted [*R.A.M.*, xvii, p. 6, 585]. Attention is drawn to the differences in varietal reaction of cabbage lettuces

(*Lactuca sativa* var. *capitata*) to mosaic which have been observed in the field and confirmed by inoculation experiments in the glasshouse. The symptoms [which are tabulated for 24 varieties] ranged from the severely necrotic type in Whitsuntide to mild mottling in Trocadero but there appeared to be little difference in susceptibility between different varieties. Cos lettuce (*L. sativa* var. *romana*), on the other hand, though equally susceptible, showed little varietal variation in symptoms. New hosts were found in groundsel (*Senecio vulgaris*), *Sonchus asper*, sweet pea, and pea. The virus was transmitted through about 6 per cent. of the seeds secured from infected plants and *Myzus persicae* proved an efficient vector under controlled conditions, but this insect is considered of minor importance in the field, where other aphids are implicated.

Lettuce mosaic is stated to be most severe on winter lettuce and a minor disease of lettuce grown under glass, the prevalence of the disease being connected with conditions which favour aphid development.

The virus was inactivated between 55° and 60° C. It aged rapidly in expressed sap and could not be detected in crude sap after 48 hours *in vitro* but inactivation was delayed in the presence of sodium sulphite. The virus, which withstood a dilution of 1 in 50, could not be filtered. For control of the disease the use of clean seed, planting on hilly and open ground unfavourable for aphid infestation, fairly late sowing of winter lettuce (to avoid aphid infestation), and eradication of weeds are recommended. The use of insecticides is advocated for the glasshouse but thought to be of doubtful value out of doors.

DRECHSLER (C.). **Several species of Pythium causing blossom-end rot of Watermelons.**—*Phytopathology*, xxix, 5, pp. 391–422, 14 figs., 1939.

Substantial losses have been found to result during wet seasons in the watermelon crop of certain regions of the Middle Atlantic States from infection by one or other of the nine species of *Pythium* known to parasitize this host. The fungi usually gain entrance into uninjured fruit through the flower scar and manifest their advance either by water-soaking or a soft, dark, chocolate- to bluish-brown discoloration of the blossom-end tissues, the latter feature being characteristic of *Pythium acanthicum* [*R.A.M.*, xv, p. 109], *P. periplocum* [ibid., xvii, p. 522], and *P. helicoides* [ibid., x, p. 211], full descriptions of which are given to supplement the previous diagnoses.

P. acanthicum, the predominant agent of the disease, produces on Lima bean decoction agar a lustrous, radiating submerged mycelium giving rise on the same medium or watermelon tissue to biciliate zoospores. Maize meal decoction agar provides a more suitable substratum for the study of the sexual apparatus of the fungus, the oogonial and oospore diameters of which ranged from 13·1 to 30·1 and 12·1 to 27·2 μ, respectively (200 of each). The oospores germinate freely on maturity without a resting period and retain their viability for three years.

P. periplocum, isolated from sand pear (*Pyrus serotina*) as well as from watermelon, is characterized on artificial media by an extremely intricate vegetative and reproductive mechanism, the lobate, elongated

antheridia frequently surrounding the echinulate oogonia in a manner reminiscent of the Saprolegniaceae, *Aphanomyces* and *Plectospira*. The oogonial and oospore diameters were found to range from 15·1 to 32·1 and 13·1 to 27·1 μ, respectively.

In essential features of morphology and development the asexual reproductive stage of *P. helicoides* approximates closely to the zoosporangial phase of *P. proliferum* [ibid., vii, p. 253], but conspicuous departures from this familiar type are apparent in the sexual mechanism of the former. The elongated, cylindrical antheridia become virtually fused, from the basal septum to the rounded apex, with the oogonial wall along an arc often equivalent to more than a quarter of the oogonial circumference, while a highly characteristic relationship of the filaments supporting the sex organs is consistently present in a helicoid involvement of an oogonial by an antheridial hyphal element, at least one such spiral arrangement being associated with each unit of sexual apparatus. The internal organization of the oospores of *P. helicoides* is also peculiar, the oily reserve material, instead of being concentrated in a single, large, central globule, being divided into half-a-dozen to a score of smaller ones, while two to four refringent bodies, in place of one, may be embedded in the granular material.

Inoculations on watermelons with the comparatively rare species *P. anandrum*, originally isolated from a rhubarb crown [ibid., x, p. 211], resulted in a fairly rapid decay, manifested externally by dark-brown discoloration. In pure culture on maize meal agar it develops a gracefully branching mycelial habit similar to that of *P. de Baryanum*, *P. irregulare*, or *P. mamillatum*. The average oogonial and oospore diameters are 23·1 to 33·1 and 19·1 to 28·7 μ, respectively. Asexual reproduction occurs sparingly in *P. anandrum*, the solitary, terminal, prolate ellipsoidal to ovoid, papillate sporangia of which resemble those of *Phytophthora citrophthora* and *P. colocasiae*, while the relative large, biciliate zoospores are typical of *Pythium*.

Schultz (H.) & Röder (K.). **Freilandbeobachtungen über die Anfälligkeit van Gurken (Cucumis sativus. L.) gegen Krätze, Blattbräune und Mehltau.** [Field observations on the susceptibility of Cucumbers (*Cucumis sativus* L.) to scab, leaf browning, and mildew.]—*Gartenbauwiss.*, xiii, 2, pp. 169–183, 5 figs., 3 graphs, 1939.

Delikatess was the only cucumber variety showing a high degree of resistance to scab (*Cladosporium cucumerinum*) [*R.A.M.*, xviii, p. 508] in three years' (1935 to 1937) field trials at the Experimental and Research Institute for Horticulture on the outskirts of Berlin. The average incidence of infection on this variety was 1·8 (taking 1 as equivalent to entire freedom from disease and 5 as heavily attacked). Among the most susceptible varieties of the 23 enumerated were the German and Russian Trauben (2·7 and 3, respectively). Similar reactions were observed in respect of *Erysiphe cichoracearum* [ibid., xviii, p. 465] in 1935 and 1936, when the average values of Delikatess, German and Russian Trauben, Hindenburg, a medium-long, full-bearing Quedlinburg type, and Riesen Schälgurken (the three last-named moderately resistant to scab) were 2·6, 4·1, 4, 4·3, 4, and 4, respectively. There were no significant differences between the test varieties in their

susceptibility to leaf browning (*Sporodesmium mucosum* var. *pluriseptatum*) [ibid., x, p. 501] during the three years under review. The incidence of *E. cichoracearum* was favoured by the dry conditions prevailing in 1935, whereas the wet season of 1936 was more conducive to the spread of *C. cucumerinum*.

Zycha (H.). **Ertragskontrolle bei Champignon-Kulturen.** [Yield control in Mushroom cultures.]—*Gartenbauwiss.*, xiii, 2, pp. 204–211, 1939.

This is an explanatory survey of the environmental and cultural conditions requisite for obtaining high mushroom [*Psalliota* spp.] yields in Germany [*R.A.M.*, xviii, p. 571], where diseases and pests are stated to reduce the crop by 10 to 15 per cent.

Bouriquet (G.). **Une grave maladie de l'Arachide à Madagascar. La 'rosette'.** [A serious disease of Groundnut in Madagascar. 'Rosette'.]—*Rev. agric. Réunion*, N.S., xliv, pp. 1–7, 1939.

In the vicinity of Lake Itasy, Madagascar, there are extensive areas in which the yield of groundnuts, owing to the presence of rosette [*R.A.M.*, x, p. 639; xvii, p. 725], amounts to only 200 kg. per hect., as against a normal yield for this locality of 1,400 kg. per hect. The disease is transmitted by *Aphis laburni*, which is present in large numbers.

Branas (J.). **Études effectuées sur le court-noué en France et en Allemagne et conclusions qu'elles permettent.** [Studies on court-noué in France and Germany and the conclusions they permit.]—*Progr. agric. vitic.*, cxi, 12, pp. 1–4; 14, pp. 5–8; 15, pp. 9–12; 16, pp. 13–16; 17, pp. 17–20; 18, pp. 21–24; 21, pp. 25–28, 7 figs., 1939. [All these are separately paged insets.]

After critically discussing the views put forward by different workers from time to time as to the nature and cause of court-noué of the vine [*R.A.M.*, xviii, p. 294], the author again expresses the opinion that the disease is due to one or more filterable viruses [ibid., xviii, p. 87] transmitted mainly by *Phylloxera* [*vastatrix* f. *radicicola*].

Observations made by the author in Germany lead him to doubt whether 'rollerkrankheit' [ibid., xviii, p. 294] is due to a different virus from that causing court-noué. The former condition occurs at Montpellier on white and red vines on which rougeau does not develop, but which show flavescence [loc. cit.]. Possibly, flavescence or pseudoflavescence may be a hitherto unrecognized symptom of court-noué. In France, vines affected by court-noué have not been observed to show rougeau, and the two conditions do not appear to be related. There is, however, no longer any possibility of doubt as to the apparent identity of 'reisigkrankheit' [ibid., xviii, p. 371] and court-noué as found in France. The prevalence of the disease in the region of the Ahr [ibid., xviii, p. 294] is very marked, and its mode of development in this locality is not incompatible with the view that spread is due to *Phylloxera*. The methods of control adopted by the local growers are critically discussed, and a French summary is given of the official German regulations for securing healthy vines for reproduction. The paper concludes with recommendations for controlling the disease in

France by assisting growers to recognize the symptoms, preventing the sale of diseased vines and parts for multiplication, and developing healthy vines from seed, where necessary.

PIROVANO (A.). **Mitteilungen über europäische Reben, die sich als resistent gegenüber Phylloxera und teilweise resistent gegenüber Peronospora erwiesen haben.** [Notes on European Vines that have given proof of resistance to *Phylloxera* and partial resistance to *Peronospora*.]—*Wein u. Rebe*, xxi, 5, pp. 144–153, 4 figs., 1939. [Italian and French summaries.]

Details are given of the author's hybridization experiments for the development of resistance in vines to *Phylloxera* [*vastatrix*] and *Peronospora* [*Plasmopara viticola*: *R.A.M.*, xviii, pp. 371, 435] at the Grottarossa Fruit-Breeding Institute, Tiber valley, a treeless region of strongly fluctuating temperatures affording ideal conditions for the growth of the fungus. Apart from certain selections among the descendants of crosses between the mildew-resistant Sciamblese and Grecco bianco with susceptible varieties, resistance has also arisen spontaneously in certain individuals resulting from hybridization between two susceptible varieties, e.g., Maddalana reale and Bicane. In some cases the character for resistance was confined to the foliage and in others to the fruits.

LIPETZKAYA (Mme A. D.). К биологии зимних спор **Plasmopara viticola.** [On the biology of winter spores of *Plasmopara viticola*.]—*Pl. Prot., Leningr., 1939*, 18, pp. 162–163, 1939.

Under conditions in the Anapa district of the U.S.S.R. *Plasmopara viticola* [*R.A.M.*, xviii, p. 435] was found to overwinter on fallen vine leaves in the form of oospores which caused the first infection in spring. Oospores perish when they remain on the plant, but survive under or on the soil surface, those from under the soil surface germinating more rapidly than those from the surface. In February the oospores require on the average 12·5 days to form conidia, in March 7·3, in April and May 5·6 to 6, but in June they need a longer moist period and often fail to germinate altogether. The optimal temperature for germination was 20° to 25°, but conidia were formed even at 7°. Oospores germinated in water drops and also in soil at 30 to 40 per cent. saturation. It is suggested that short alternating periods of wet and dry weather may accelerate germination. For the control of the disease it is recommended to cut away the green shoots and aerial roots growing at the soil surface, to tie up the shoots in order to prevent contact with the soil, and to finish all deep ploughing before the blossoms open.

BEAUMONT (A.) & STANILAND (L. N.). **Fifteenth Annual Report of the Department of Plant Pathology, Seale-Hayne Agricultural College, Newton Abbot, Devon, for the year ending September 30th, 1938.**—39 pp., 1939.

In this report [cf. *R.A.M.*, xvii, p. 583] it is stated that narcissus growers commonly add a fungicide to the hot water bath used to kill eelworms in the bulbs, in order to prevent subsequent fungal decay (mainly due to *Fusarium* spp., especially *F. bulbigenum* [ibid., xv, p. 224], and *Trichoderma viride* [ibid., xiv, p. 366]). Experimental

evidence showed that formalin (1 qt. in 100 gals.) caused no injury to bulbs of a very large number of narcissus varieties when applied over a wide range of dates, while iodine (1 in 8,000) also caused no injury to bulbs, and was even more effective against eelworms. Methyl mercury nitrate and methyl mercury chloride (1 part mercury in 10,000 of water) caused no apparent injury in most cases, but in a few instances prevented the growth of the bulb.

The following are among the records of plant diseases observed during the period under review. Purple sprouting broccoli was affected by leaf spot due to *Gloeosporium* [*Cylindrosporium*] *concentricum* [ibid., xv, p. 474]. The most serious strawberry disease was mildew [*Sphaerotheca humuli*: see below, p. 693], which appeared on the berries before they were picked, and in some districts ruined the crop. During May, *Zinnia* seedlings in north Devon were badly affected by small dark spots on the leaves bearing beaked spores of a species of *Alternaria* [ibid,. xvii, p. 96], probably identical with *Macrosporium caudatum* [ibid., ii, p. 488; vii, p. 787]. Lilac was attacked by leaf blotch (*Heterosporium syringae*) ibid., xvi, p. 751], barberry (*Mahonia aquifolium*) by rust (*Puccinia mirabilissima*) [*Cumminsiella sanguinea*: ibid., xvi, pp. 257, 342], and violet by crown rot (*Sclerotium delphinii*) [ibid., xviii, p. 183].

WORMALD (H.). **Notes on plant diseases in 1938.**—*Rep. E. Malling Res. Sta., 1938*, pp. 167–172, 1939.

These notes on plant diseases studied at East Malling in 1938 [*R.A.M.*, xvii, p. 688] contain the following items of interest. In December, papery bark cankers were noted round pruning cuts on cordon Cox's Orange Pippin apple trees. No parasite was associated with the condition, which appears to have been due to pruning during a rainy period in September, an unsuitable time.

Sclerotinia fructigena was observed in its *Monilia* stage on a medlar fruit at West Malling, apparently for the first time on this host in England. Strawberries were more widely affected by mildew (*Sphaerotheca humuli*) [ibid., xviii, p. 604] than is usual. The leaves were infected and curled, and the flowers and pedicels were attacked, infection being present on the stamens and pistils. In addition, the flower petals were small and highly coloured.

A four-acre field of Yellow Globe mangolds was attacked by violet root rot (*Rhizoctonia crocorum*) [*Helicobasidium purpureum*: ibid., xvii, pp. 368, 796]. Infection in nearly one half of the field reached 50 to 70 per cent., and a few isolated infections were found in the remainder. *Polygonum aviculare*, *P. persicaria*, *Mentha arvensis*, and *Chenopodium album* growing in the same field were also affected.

Victoria plum trees on Purple Egg and Myrobolan B stems at East Malling have not shown any bacterial cankers (*Pseudomonas mors-prunorum*) [see below, p. 689], but those on Pershore (Yellow Egg) have been as severely affected as those on Victoria stems. Morello cherry trees in two plots showed a bacterial leaf spot due to an organism apparently identical with *P. mors-prunorum*.

Hop nettlehead disease [ibid., xvi, p. 836] was very serious in some gardens, a large number of affected plants being grubbed in Kent and the West Midlands.

Lepik (E.). **Estonia : plant diseases new to the country.**—*Int. Bull. Pl. Prot.*, xiii, 5, pp. 105–106, 1939.

Of the nine records of plant diseases newly recorded in Estonia, six have already been noticed in this *Review*, the others being *Botrytis paeoniae* and *B. tulipae* on peonies and tulips, respectively [*R.A.M.*, xvii, pp. 96, 112] and *Ceratophorum setosum* on lupins [ibid., xviii, p. 460].

Seth (L. N.). **India : new diseases recorded in Burma during the year 1938.**—*Int. Bull. Pl. Prot.*, xiii, 6, p. 132, 1939.

During 1938 the following diseases were observed for the first time in Burma: *Cystopus candidus* on cabbage, a species of *Pestalozzia* causing leaf spot of *Aleurites montana*, and a species of *Phytophthora* responsible for root rot of *Achras sapota*.

Park (M.). **Report on the work of the Division of Plant Pathology.**—*Adm. Rep. Dir. Agric., Ceylon, 1937*, pp. D42–D48, 1939.

In this report it is stated that root disease of *Hevea* rubber [*Fomes lignosus, F. noxius*, and *Poria hypobrunnea*: *R.A.M.*, xvii, pp. 202, 293] is becoming prevalent in the young replanted areas and on some estates control is proving difficult. Evidence indicated that *Polyporus zonalis* [ibid., xv, p. 471; xvii, p. 88] is parasitic on young rubber and on the bushy green manure plants used as indicators.

Chlorosis of *Hevea* rubber in a nursery on an old lime site was associated with alkaline soil, and was corrected by a dressing of flowers of sulphur. Bird's eye spot (*Helminthosporium heveae*) [ibid., xvii, p. 63], troublesome in some nurseries, was controlled by spraying with a standard copper fungicide.

Other diseases occurring included *Melanconium fructicolum* on pomegranate fruits [ibid., xii, p. 77], *Phytophthora palmivora* on papaw fruits and stems [ibid., xvi, p. 559], and an apparently physiological disease of *Garcinia mangostana* in which the fruits exuded resinous matter and showed partial internal necrosis. Among the diseases recorded for the first time in Ceylon were collar disease of *Achras sapota* due to *Septobasidium* sp., leaf disease of yams (*Alocasia* sp.) (*P. colocasiae*) [ibid., xvii, pp. 587, 731], collar and root disease of *Cicer arietinum* (*Corticium*), root disease (*Poria hypolaterita*) of sweet orange, downy mildew of *Luffa acutangula* (*Pseudoperonospora cubensis*), and *Alternaria solani* on potato.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, 1, 5, pp. 248–251, 3 figs., 1939.

In these notes it is stated that the New South Wales Department of Agriculture has decided to express the dilution of lime-sulphur mixtures recommended for spraying purposes as the percentage of polysulphide sulphur present by volume, and has abandoned the use of Baumé readings in this connexion. A table is given showing how much water must be added to stock solutions of lime-sulphur containing given percentages of polysulphide sulphur to make a spray containing any required percentage of this constituent.

The Eureka wheat variety is stated to be highly resistant to stem

rust [*Puccinia graminis*], while Ford and Gluford are resistant, and Bordan, Canimbla, Apollo, Bencubbin, Geeralying moderately resistant, the last three being highly resistant to flag smut [*Urocystis tritici*]. Oat varieties resistant to stem rust are Burke, Lampton, and White Tartarian.

Twelfth Annual Report of the Commonwealth Council for Scientific and Industrial Research for the year ended 30th June, 1938.—96 pp., 1938. [Received March, 1939.]

Among the many items of interest in this report [cf. *R.A.M.*, xvii, p. 443] the following may be mentioned. A roughening and cracking of the calyx end of Beurré Bosc pears responded to boron treatment, but pear 'crinkle' (a condition apparently resembling internal cork of apples) was unaffected by boron applications.

Further experiments on the reduction of the root system of young wheat plants infected with flag smut [*Urocystis tritici*: ibid., xvi, p. 664; xviii, p. 373] gave statistically significant results, showing that reduction is almost the same in susceptible and resistant varieties.

Field investigations demonstrated that the pathogenicity to wheat of *Ophiobolus graminis* [ibid., xviii, p. 385] and the amount of seedling blight resulting from artificial inoculation conspicuously increased with depth of seeding.

During the last three seasons data obtained have shown that four virus diseases of potatoes are important in Australia. The chief is mild mosaic or crinkle due to a combination of viruses X+A, the symptoms of which are so varied on different varieties that they have been regarded as distinct diseases. The next in importance is leaf roll. This generally attacks varieties showing resistance to mild mosaic. The third is rugose mosaic, due to viruses X+Y; the symptoms are more severe than those of mild mosaic, but the disease occurs much less often than mild mosaic on the potato varieties commonly grown in Australia. Spindle tuber is also present. Most of the common potato varieties are almost everywhere infected with virus X, the symptoms produced under field conditions being slight or imperceptible.

Diplodia pinea [see above, p. 643] was associated with extensive die-back of *Pinus* spp. near Canberra. Inoculation experiments demonstrated that the fungus readily established itself in terminal growths, but in trees healthy in other respects it did not, as a rule, progress far from the point of inoculation.

Investigations on timber decay treatments showed that in South Australia all the *P. radiata* poles impregnated with creosote [ibid., xv, p. 332] were sound, whereas over half the untreated poles had been destroyed by decay or termites in about two years. In Victoria, poles impregnated with creosote oil were still in good condition, as were others de-sapped and seasoned and then treated by the oxyacetylene process, though all the other treatments had permitted decay. The value of brush treatment with creosote oil and puddling was demonstrated, particularly with poles set green. The condition known as 'heart' in *Eucalyptus regnans* was fairly constantly associated with *Gonytrichum caesium* in fresh material collected from young trees.

When citrus fruits were passed over a commercial sizer more wastage

due to moulds (*Penicillium digitatum* and *P. italicum*) resulted than when the fruits were sized by hand [cf. ibid., xvii, p. 741]. Data showed that storage spot and other low temperature disorders of Washington Navel oranges cannot always be controlled by immediate storage at 45° F. [ibid., xvii, p. 741], but sweating and ethylene treatments gave promising results in the subsequent control of these troubles. Oranges are much less susceptible to storage spot when they have reached the phase of constant respiration.

Storage studies with Jonathan apples showed that the less mature fruits pass through a period of maximum liability to scald [ibid., xviii, p. 443] and minimum liability to Jonathan spot [ibid., xviii, p. 236] when they have passed the climacteric and are approaching the period of constant respiration. Preliminary holding at 65° resulted in greater liability to scald than preliminary holding at lower temperatures. Atmospheres containing 5 per cent. of carbon dioxide and 10 to 16 per cent. of oxygen increased storage life, mainly by controlling Jonathan spot. Higher concentrations of carbon dioxide and lower concentrations of oxygen were injurious.

Plant pathology.—*Rep. Hawaii agric. Exp. Sta., 1938*, pp. 34–40, 1939.

In this report [cf. *R.A.M.*, xvii, p. 731] it is stated that a papaw disease new to Hawaii with symptoms resembling those of yellow crinkle [ibid., xvii, pp. 259, 376] appeared on the island of Oahu in 1937 [see below, p. 693].

The tomato ring spot disease previously recorded [ibid., xvii, p. 732] was transmitted mechanically by the carborundum method to tomato, potato, and *Emilia sonchifolia* from tomato and *E. sonchifolia* and by grafting from tomato to tomato and potato. The incubation period in the tomato was 10 to 16 days, depending on vigour of growth; the more vigorous the growth after inoculation, the more rapidly the symptoms appeared. The virus quickly lost its infectivity in extracted juice, and after one week was recovered from diseased plants only with difficulty. It was not seed-transmitted. On *Emilia* the symptoms are identical with those of pineapple yellow spot [ibid., xviii, p. 465].

The *Pythium* species causing soft rot of taro [*Colocasia esculenta*: ibid., xvii, p. 731] effects entry through the root, particularly in the region of root hair development. Under aerobic conditions the fungus is not a virulent pathogen, but it causes serious losses to plants growing in an unfavourable environment. It grows readily on all common synthetic media, producing abundant aerial mycelium. Chlamydospores occasionally developed in old cultures on oatmeal and potato dextrose agars. Sporangia generally formed in 48 to 60 hours at 28° to 30° C. when aerial mycelium from two- to three-day-old cultures on oatmeal agar or Mehrlich's malt medium were placed in water. The sporangia, which measured 16 to 41·6 by 12·8 to 33·6 (mean 28·8 by 22·4) μ, were borne terminally on short side branches of a main hyphal strand, two to three frequently occurring on a somewhat short length of hypha. They were not cut off from the mother hypha by a septum. They proliferated freely, five successive structures sometimes being produced. Free swimming zoospores were produced in 20 to 30 minutes, sometimes less, after initial vacuolation of the prosporangium. A thin-walled

vesicle was extruded, into which the protoplasm passed before the swarm spores became differentiated. No sexual bodies were observed in agar culture or diseased roots. In old diseased roots prosporangia appeared as globose, empty cells with a well-defined wall, and averaged 24·6 by 22·4 μ (wall 1·6 μ thick), closely approximating in size to the average for sporangia produced in the laboratory. The best method of control would appear to consist in improved cultural practices, especially the drying and deep ploughing of the land.

Vascular necrosis of taro corms [loc. cit.] has never been reproduced under laboratory conditions and is not attributable to any specific organism. Unfavourable growing conditions causing the roots to die appear to be responsible, the necrosis then spreading to the interior of the corm along the vascular system. Planting material from non-submerged soil in which the condition does not occur shows 15 to 30 per cent. disease when planted in submerged soil, while material from diseased corms planted in non-submerged soil does not develop the disease. Experimental evidence showed that the varieties Mana Uliuli, Mana Ulaula, Mana Ulu, Mana Eleele, and Kai Kea are apparently immune from vascular necrosis, while Kai Uliuli, Ulaula Kumu, and Kakakura-ula are highly resistant. No variety had under 10 per cent. soft rot, but Moi, Ohe, Oene, Palaii, Kai Uliuli, Kumu Eleele, and two unclassified varieties had under 20 per cent. Kai Uliuli combined resistance to both diseases and gave the highest yield.

Ergot (*Claviceps paspali*) [ibid., xviii, p. 529] of *Paspalum dilatatum* and *P. orbiculare* was observed near Makawao, Maui, in December, 1937, and has since been found in various districts. Other records include stem canker and fruit rot of loquat due to *Botryosphaeria ribis chromogena* [ibid., xvii, p. 755], fruit spot of chilli (*Colletotrichum nigrum*) [ibid., xvii, p. 346], tomato fruit rot (*C. phomoides*) [ibid., xvi, p. 419], and leaf spot of lucerne (*Phyllosticta medicaginis*) [ibid., xviii, p. 397].

Dowson (W. J.). **On the systematic position and generic names of the Gram-negative bacterial plant pathogens.**—*Zbl. Bakt.*, Abt. 2, c, 9–13, pp. 177–193, 1939.

From a detailed examination of the cultural and biochemical characters of a large number of Gram-negative bacterial plant pathogens (only about seven of 100 carefully authenticated organisms being Gram-positive), the author found that they could be arranged in three distinct groups, (*a*) those like *Bacterium coli* and producing acid or acid and gas in salicin, (*b*) those like *Pseudomonas fluorescens*, failing to produce acid in lactose, maltose, and salicin but secreting fluorescin in certain media, and (*c*) those producing on solid media a most characteristic, abundant, slimy, yellow growth but failing to form acid in salicin.

The naming of these three groups necessitated an examination of the causes responsible for the present confusion in the classification of bacteria. The causes are stated to be (1) the use of more than one system of classification in which the same generic name has been differently applied, e.g., *Bacterium* and *Bacillus* of Migula, Smith, and Lehmann and Neumann; (2) the erection of a genus on one character alone, either non-motility, e.g., *Bacterium* Migula and *Aplanobacter*, or

pathogenicity, e.g., *Erwinia* and *Phytomonas*, neither of which is justified; and (3) failure to appreciate the significance of the Gram reaction which indicates a fundamental difference in the proteins of the two groups and probably absence of relationship. The genera *Listerella* and *Kurthia*, with polar and peritrichous flagella, respectively, have been founded by animal bacteriologists for Gram-positive, non-sporing rods, but it is not known how close to them is the relationship of the plant pathogens with these characters.

From a consideration of these points the author considers that since *Bacillus* has now been defined to exclude non-sporing rods and *Phytomonas* is suppressed as a homonym [*R.A.M.*, xviii, p. 597], only *Bacterium* Lehmann and Neumann and *Pseudomonas* Migula are applicable as generic names to the Gram-negative plant pathogens. *Bacterium* is applied to group (*a*), the other characters of the genus being as follows: non-sporing, rod-shaped, Gram-negative bacteria, motile by means of peritrichous flagella, or non-motile, grey or transparent on nutrient agar, forming creamy, later yellowish, growths on potato. *Pseudomonas* Migula is applied to group (*b*), comprising non-sporing, rod-shaped, Gram-negative bacteria, motile by means of polar flagella, 1 to 7 (average 3) in number, never non-motile when young, white or transparent on beef infusion and on starch agar, in both of which fluorescin is produced by most species, forming creamy, later pink, growths on potato. *Xanthomonas* n.g. is proposed as a name for the group (*c*) and is defined as non-sporing, rod-shaped, Gram-negative bacteria, uni- or rarely biflagellate or non-motile, forming abundant yellow, slimy colonies on nutrient agar and potato, and mostly digesting starch and producing acid in lactose but not in salicin. The type species is *X. hyacinthi* and other species transferred to the genus are: *X. campestre*, *X. phaseoli*, *X. stewarti*, *X. vasculorum*, *X. juglandis*, *X. malvacearum*, *X. pruni*, *X. citri*, *X. translucens*, *X. hederae*, *X. vesicatorium*, *X. cucurbitae*, *X. papavericola*, *X. ricinicola* (=*X. ricini*), *X. geranii*, and *X. flavozonatum*.

Khudyakoff (Y. P.) & Raznitzyna (Mme E. A.). Применение миколитических бактерий путем бактеризации семян при яровизации. [The use of mycolytic bacteria for the inoculation of seed during vernalization.]—*Bull. Acad. Sci. U.R.S.S.*, *1939*, Sér. biol., 1, pp. 117–120, 1939.

The use of mycolytic bacteria for the prevention of fungous infection during vernalization of cereal seed-grain was demonstrated in pot experiments with spring wheat Caesium 0111 and *Fusarium graminearum* [*Gibberella saubinetii*]. The grain yields of plants grown from seed soaked for 24 hours in a liquid culture of mycolytic bacteria F–80, in a water suspension of *G. saubinetii*, or in a mixture of the suspension of the fungus with the bacterial culture or a filtrate of it was 126·6, 26·9, 128·6, and 115·5 per cent., respectively, compared with 100 per cent. in the control plants raised from seed soaked in water. Similar results were obtained with the bacterial isolation F–24, but it reduced the yield of straw below that of the control. In inoculation experiments made in many replications seed-grain treated with mycolytic bacteria, particularly F–80, was not attacked by *G. saubinetii*, while that left

untreated invariably became infected and perished soon after germination.

SIMMONDS (P. M.). **A review of the investigations conducted in Western Canada on root rots of cereals.**—*Sci. Agric.*, xix, 9, pp. 565–582, 1939.

In this paper, to which a bibliography of 134 titles is appended, the history of investigations on root rots of cereals in Europe and the U.S.A. is outlined and a review is given of the work done in Western Canada on the take-all root rot (*Ophiobolus graminis*) [*R.A.M.*, xviii, p. 585], browning root rot (*Pythium arrhenomanes* var. *canadense* [ibid., xvi, p. 308] and *P. volutum*) [ibid., xvii, p. 735], and common root rot (*Helminthosporium sativum*, *Fusarium culmorum*, and *F. graminearum* [*Gibberella saubinetii*]).

LANGE-DE LA CAMP (MARIA). **Die Weizen der deutschen Hindukusch-Expedition 1935.** [The Wheats of the German Hindu Kush expedition, 1935.]—*Landw. Jb.*, lxxxviii, 1, pp. 14–133, 35 figs., 2 graphs, 5 col. maps, 1939.

This is an exhaustive description of the writer's examination of the wheat plants raised at the Halle Plant Breeding Institute from nearly 850 samples of seed-grain collected by the German Hindu Kush expedition of 1935. The account includes full particulars of the reaction of the stands to spontaneous and artificial infection by certain important diseases.

BAYLES (B. B.) & TAYLOR (J. W.). **Wheat improvement in the eastern United States.**—*Cereal Chem.*, xvi, 2, pp. 208–223, 1 map, 1939.

In connexion with a discussion of the wheat improvement programme for the eastern United States, the writers tabulate and comment upon the losses caused by the operation of various adverse factors, including fungal diseases. The average yield reductions (mostly in the soft red winter varieties) from stem and leaf rusts [*Puccinia graminis* and *P. triticina*: *R.A.M.*, xviii, pp. 94, 299, 384, *et passim*] from 1909 to 1937 were 2,944,000, 1,844,000, and 2,169,000 bush. (10·7, 5·4, and 5·1 per cent.) for Missouri (30 per cent. in 1937), Illinois, and Ohio, respectively, other States suffering less severely, and two (Delaware and New Jersey) being practically free from the diseases in question throughout the period under review. Breeding for resistance to *P. graminis* and *P. triticina* has made much greater progress in the hard red spring than in the winter wheats. Thatcher, for instance, which has been grown commercially since 1934, sustained very little loss in the severe rust epidemics of 1935 and 1937 [ibid., xviii, p. 374], and other new hybrids, not yet available for distribution, are even more resistant. Two specially interesting crosses are Hope × Hussar (C.I. 11682) and Mediterranean × Hope (C.I. 11763), both of which are highly resistant to *P. graminis* and *P. triticina* and are undergoing further crossing with commercial soft red types to develop lines combining this quality with other desirable features. Wabash (C.I. 11384) is being recommended for Indiana and Illinois.

The heaviest average losses (2 to 2·6 per cent.) from loose smut [*Ustilago tritici*] during the years 1917 to 1936 occurred in the foothills

and mountainous areas of North Carolina, Kentucky, Maryland, Arkansas, Georgia, Pennsylvania, West Virginia, and Virginia. In the other twelve States under observation the reductions ranged from 0·7 (Delaware) to 1·8 per cent. (Michigan). Until recently, breeding for resistance to loose smut [ibid., xvii, p. 509; xviii, p. 447] was given little consideration, but an improvement in the method of flower inoculation has facilitated the approach to this problem.

During the period from 1928 to 1936 the heaviest yield reductions in soft red winter wheats from bunt (*Tilletia levis* [*T. foetens*] and *T. tritici* [*T. caries*: ibid., xviii, pp. 170, 441, *et passim*]) among the carloads examined at the terminal markets occurred in material from Maryland and Pennsylvania (22 and 14·6 per cent., respectively, graded bunted), the corresponding figures for Michigan, Ohio, and Indiana being 2·4, 2·2, and 2 per cent., respectively, and the total for all States 3·2 per cent.

Other diseases demanding special attention in certain areas are mosaic [ibid., xvii, p. 378] in southern Indiana and Illinois, leaf spot (*Septoria tritici*) [ibid., xviii, p. 297] and glume blotch (*S. nodorum*) [ibid., xiv, p. 348] in the Atlantic Coastal Plains region, and scab [*Gibberella saubinetii*: ibid., xvi, p. 374] in the Corn Belt.

Derzhavin (A. I.). Результаты работ по выведению многолетних сортов Пшеницы и Ржи. Тезисы. [Results of work on breeding perennial varieties of Wheat and Rye. Theses.]—*Bull. Acad. Sci. U.R.S.S., 1938*, Sér. biol., 3, pp. 663–665, 1938. [Received 1939.]

An amphidiploid plant with 42 chromosomes was obtained by crossing the wheat *Triticum durum* var. *leucurum* 1364/1 with the perennial rye *Secale montanum*, and from this hybrid several thousand plants have been obtained of which only six have a tough rachis and are being further selected. They appear to be immune from yellow and black rusts [*Puccinia glumarum* and *P. graminis*], highly resistant to brown rust [*P. triticina*], and so far free from bunt [*Tilletia caries* and *T. foetens*] and smut [*Ustilago tritici*]. The hybrid progeny cross readily with hard and soft wheats.

Steiner (H.). **Über die Verbreitung der Berberitze (Berberis vulgaris L.) in der Ostmark.** [On the distribution of the Barberry (*Berberis vulgaris* L.) in the Ostmark.]—*Landw. Jb.*, lxxxviii, 1, pp. 1–11, 1 map, 1939.

This is a detailed account of the distribution of the barberry in the Ostmark [Germany, formerly Austria] based on a recent survey by phytopathological experts of the Vienna Agricultural Institute with a view to the control of black rust of cereals (*Puccinia graminis*) by the eradication of the alternate host [*R.A.M.*, xiii, p. 752].

Garbowski (L.). **Studia nad pszeniczną rdzą źdźbłową Puccinia graminis tritici (Pers.) Er. et Henn. w Polsce w okresie 1933–1937 r.** [A study on the stem rust of Wheat *Puccinia graminis tritici* (Pers.) Er. & Henn. in Poland during the years 1933–1937.]—*Prace Wydz. Chor. Szkodn. Rośl. państw. Inst. nauk. Gosp. wiejsk., Bydgoszcz*, 18, pp. 5–76, 7 pl., 1 map, 1939. [French summary.]

Forty-three samples of black rust of wheat (*Puccinia graminis*) collected in 20 different localities of Poland during the period 1933 to 1937

were tested for the presence of physiological races on the standard test varieties. The races 40, 21, 14, 17, 34, and 27 were found to be present and also a new race, from which Reliance and Kota were immune, while Vernal, Khapli, and Acme were highly resistant, Arnautka, Mindum, Spelman, and Kota moderately so, and Einkorn, Marquis, and Little Club slightly susceptible. In culture races 40, 14, 17, 34, and the new race formed the teleuto stage more or less readily about $3\frac{1}{2}$ to $4\frac{1}{2}$ weeks after inoculation, while race 21 only sometimes developed the teleuto stage and then after a longer period. Race 40, cultured on Little Club wheat, produced light brown, almost ochre-coloured uredospores, while those of races 21 and 14 approximated to coffee-brown. In cultures of race 17 some uredospores were darker than others and these lines proved to be more virulent on Vernal and Reliance, while the lines with the lighter coloured uredospores seemed to resemble in their reactions the line 17a, established by American investigators [*R.A.M.*, x, p. 169]. All the 64 Polish varieties of winter wheats tested proved to be susceptible to races 21, 14, 27 and particularly to race 40; of the 12 spring wheats tested, Ordynatka, Ostka Pulawska, and Ostka Hildebranda were resistant to races 40, 21, and 14, but slightly susceptible to race 27, whereas Kalinowiecka, Pulawska Twarda, and Sieburczyńska were resistant to race 27, but susceptible to races 40, 21, and 14.

McFadden (E. S.). **Brown necrosis, a discoloration associated with rust infection in certain rust-resistant Wheats.**—*J. agric. Res.*, lviii, 11, pp. 805–819, 4 figs., 1939.

When wheat varieties possessing a specific type of mature-plant resistance to stem rust (*Puccinia graminis tritici*), such as Hope and H–44, were artificially inoculated with the spores of the rust or exposed to natural infection, they developed a melanistic reaction or discoloration referred to as 'brown necrosis'. Brown or purplish-brown blotches appeared on the culms, peduncles, glumes, and rachises, and occasionally on the awns and leaf sheaths. The lower margins of the blotches on the stems, just below the nodes, were generally striated. Blotches were less frequently present on the sheaths, and often took the form of haloes surrounding chlorotic areas. The blotches generally became visible during the second week after heading, shortly afterwards turning dark brown or almost black; at this time, many of the plant cells developed necrosis. The discoloration usually reached maximum development in a given variety a few days after its first appearance, after which little further development occurred in the variety except on later maturing culms.

A review of the literature indicates that this brown necrosis has been confused with lesions produced by several different disease organisms, especially black chaff (*Bacterium translucens* var. *undulosum*) [see below, p. 665].

Two distinct types of mature-plant resistance to stem rust were found in segregates from an H–44—Marquis wheat cross, a 'photologic' (expressed only under high light intensity) and a morphologic. Brown necrosis developed only on plants with photologic resistance to stem rust. This may perhaps explain earlier reports of close but incomplete

linkages and associations between resistance to stem rust and susceptibility to so-called black chaff.

Inoculation tests with F_2 plants from a cross between H-44 and Marquis suggest that it may be practicable to use the brown necrosis reaction as an indicator for identifying plants with photologic resistance early in their development. As this determination can be made before blooming, it would facilitate breeding for rust resistance by the backcross method.

CHESTER (K. S.). **The 1938 Wheat leaf-rust epiphytotic in Oklahoma.**—*Plant Dis. Reptr, Suppl.* 112, 18 pp., 1 graph, 1 map, 1939. [Mimeographed.]

Mild winter and relatively high spring temperatures, coupled with a persistent spring rainfall, are thought to have contributed largely to the exceptionally severe epidemic of wheat leaf rust (*Puccinia rubigo-vera tritici*) [*P. triticina*] in Oklahoma in 1938, the crop being stimulated by these conditions to the rank, succulent type of growth most susceptible to infection. Large areas, moreover, were planted with the susceptible Turkey, Blackhall, Fulcaster, and Cheyenne varieties. The disease was the chief cause of the 25 to 30 per cent. reduction in the yield and quality of the crop.

YABLOKOVA (Mme V. A.). **Response of the mycelium of Ustilago tritici in Wheat grain to ultra-violet rays as dependent upon its condition.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xxiii, 4, pp. 392–394, 1 fig., 1939.

The fluoromicroscopic method described in this paper for the detection of living mycelium of *Ustilago tritici* in wheat seed-grains should prove extremely useful for the study of fungi in the living tissue of the host plant where the method of vital staining is of no avail. The technique adopted consisted in inoculating seed-grain of the varieties Albosar, Lutescens 062, and Albidum 721 with *U. tritici*, keeping them in the thermostat at 26° to 28° C. for one to six days, cutting longitudinal sections through the centre of the embryo, immersing them in a drop of freshly prepared 0·005 per cent. solution of Kahlbaum's eosin yellow with 0·1N potassium nitrate for three minutes, and then thoroughly washing them in distilled water, and examining them in ultraviolet light with a fluorescent microscope. The mycelium of *U. tritici* was distinctly visible in the embryo, fluorescing with a bright canary-yellow hue against the pale greenish-yellow fluorescence of the embryo tissues. In seed-grain subjected to the standard wet thermal treatment for the control of the smut (four hours at 30° and eight minutes at 52°), the mycelium seemed to be intact and was growing in the embryo, but its fluorescence was weaker than in the untreated material. It is concluded that the mycelium of the smut is injured rather than killed by the treatment and dies at a later stage. Dead mycelium observed in the grain heated at a temperature of 55° showed a still weaker fluorescence and the hyphae had lost the purity of their colour. The method thus provides a means of distinguishing dead from living mycelium in the host plant.

JOHNSTON (C. O.) & LEFEBVRE (C. L.). **A chlorotic mottling of Wheat leaves caused by infections of Tilletia laevis.**—*Phytopathology*, xxix, 5, pp. 456–458, 1 fig., 1939.

Attention is drawn to a chlorotic mottling of the foliage, especially the basal leaves, of greenhouse plants of the spring wheat varieties, Prelude, Webster, Warden, Pusa No. 4, and a selection from the cross Pusa No. 52 × Federation inoculated with *Tilletia levis* [*T. foetens*] at the Kansas Agricultural Experiment Station in 1935 and 1936, when a similar condition was observed in bunted greenhouse plants of the winter wheats, Turkey, Tenmarq, and Blackhull, and in various winter varieties in the field bunt nursery. In greenhouse experiments in 1936, mottling was observed in all but one of the inoculated plants of Pusa No. 4, Prelude, and Pusa No. 52 × Federation, whereas the only non-inoculated plants similarly affected were four of Prelude, two of which were attacked by loose smut [*Ustilago tritici*]. Under field conditions the foliar mottling caused by *T. foetens* is not so easy to identify as in the greenhouse, and should not be used alone as a method of predicting the extent of infection, though it may well serve as an auxiliary for this purpose, especially in spaced sowings and among hybrid families of marked susceptibility or resistance to bunt, as opposed to those of intermediate reaction.

LAL (A.). **Interaction of soil micro-organisms with Ophiobolus graminis Sacc., the fungus causing the take-all disease of Wheat.**—*Ann. appl. Biol.*, xxvi, 2, pp. 247–261, 2 graphs, 1939.

In a study in England on take-all disease [*R.A.M.*, xviii, p. 386] *Ophiobolus graminis* was most frequently isolated from infected wheat roots two to four weeks after inoculation, while later there was less mycelium present. The fungus persisted longer (over five months) in sandy and alkaline soils, disappearing after a few weeks from acid ones. Large numbers of micro-organisms, among which *Trichoderma lignorum* was prominent, were isolated from infected roots and the disappearance of *O. graminis* is ascribed to their activity. It is suggested that the persistence of *O. graminis* in sand is due to the comparative absence of soil organisms. When grown on agar in the same Petri dish with *O. graminis*, especially in acid media, *Fusarium culmorum*, *Rhizoctonia* sp., and a strain of *T. lignorum* produced a staling effect on *O. graminis* at a greater distance between the two colonies (1·5 cm. and over) than any other organism tested and finally completely overgrew it and inhibited its growth. In soil cultures the growth of *O. graminis* after ten days' incubation at 25° C. was 3·56 cm. in the absence of soil organisms, nil in the presence of certain of them, and 1·3 to 0·1 cm. in that of others. In media to which filtered cultural solutions of various soil fungi and bacteria were added, the growth of *O. graminis* was either completely inhibited, retarded, or unaffected, the addition of nutrients or dilution making little difference, while boiling repressed the inhibiting effect in one case only. This inhibiting or retarding effect of the soil organisms is considered to be induced by their metabolic products. *Ophiobolus* mycelium subjected for five to eight days to contact with the staled media of certain fungi was rendered non-pathogenic, while others had little or no effect. The antibiotic effect of the various

organisms on *O. graminis* in soil was found to range from nil to complete inhibition of its pathogenicity.

HANNA (W. F.). **Coprinus urticaecola on stems of Marquis Wheat.**—*Mycologia*, xxxi, 3, pp. 250–257, 2 figs., 1939.

Coprinus urticaecola, with which *C. phaeosporus* and *C. brassicae* are considered to be synonymous, was found at Winnipeg in 1934 forming fruit bodies on the leaf sheaths of green plants of Marquis wheat near ground-level, and again in 1937 on decaying nettle stems. Fruit bodies of the fungus were produced by diploid cultures of the mycelium on sterilized soil, horse dung, or old wheat stems, but failed to appear on wheat plants inoculated with pure cultures of the mycelium in the greenhouse. The species is described and illustrated.

FRÖIER (K.). **Brunfläcksjuka (Bacterium translucens var. undulosum) och dess angrepp på olika Vetesorter.** [Brown spot disease (*Bacterium translucens* var. *undulosum*) and its pathogenicity to different Wheat varieties.]—*Nord. JordbrForskn.*, *1938*, 4–7, pp. 536–543, 1938.

Details are given of the reaction to black chaff of wheat (*Bacterium translucens* var. *undulosum*) [*R.A.M.*, xvii, pp. 16, 384, 435, 509] in hybridization experiments carried out at Svalöf, Sweden, from 1918 to 1922 (between Brown Schlanstedt and 0715, a selection from Börsum) and again in 1937 (using Extra Club II × Aurora and others), the outcome of which demonstrated the hereditary character of relative resistance (for immunity does not appear to exist) to the disease. Of the varieties used in the 1937 trials, a high degree of susceptibility was manifested by Atle, while Fylgia, Extra Club, and especially the newly developed Diamond (all spring wheats) were very resistant.

FISCHER (G. W.). **Studies of the susceptibility of forage grasses to cereal smut fungi. II. A preliminary report on Ustilago hordei and U. nigra.**—*Phytopathology*, xxix, 6, pp. 490–494, 1939.

The preliminary results of the author's studies in Washington on the spontaneous infection of *Agropyron cristatum* and *Elymus glaucus jepsoni* by the covered smut of barley (*Ustilago hordei*) [*R.A.M.*, xvii, p. 825] are presented.

Three collections of the smut from these two hosts and one from Beldi Giant barley were grown on potato dextrose agar, and monosporidial cultures of opposite sex, together with similar material of *U. levis* [*U. kolleri*], used for the cross-inoculation of Canadian oats and Beldi Giant and Trebi barley. Both the latter contracted smut from each of the three grass collections of *U. hordei*, from the Beldi Giant strain, and from all the crosses between the collections in every possible combination. Oats were infected only by *U. kolleri* without admixture. These data are considered to substantiate the morphological similarity to *U. hordei* of the covered smut on the two grasses under observation, if not to establish the identity of the barley and grass strains.

In inoculation tests on 25 grasses with each of the three grass collections of *U. hordei* and one from Beldi Giant barley, 10 to 50 per cent. infection was obtained on *A. caninum*, *E. canadensis*, *E. glaucus jepsoni*,

E. sibiricus, *Hordeum nodosum*, and *Sitanion jubatum*. Corresponding experiments with *U. nigra* resulted in 30 to 50 per cent. infection on *E. canadensis*, *H. nodosum*, and *S. jubatum*.

D'Oliveira (B.). **Estudos sôbre a Puccinia anomala Rost.** [Studies on *Puccinia anomala* Rost.]—*Agron. lusit.*, i, 1, pp. 64–86, 1939. [English summary.]

Continuing his studies on two of the physiologic races (12 and 17) of barley rust (*Puccinia anomala*) of English and Portuguese origin [*R.A.M.*, xviii, p. 387], the writer found that the uredospores were unable to germinate at 28° C. and that the mycelium succumbed when the host was continuously maintained at 30°. The duration of exposure to a given temperature evidently plays an important part in the reaction of the different physiologic races to this factor, the mean temperature in itself being of relatively slight significance. Darkness did not affect uredospore or aecidiospore germination or the entry of their germ-tubes into the host tissues, but considerably modified the expression of the symptoms in different varieties: for instance, in the resistant *Hordeum vulgare speciale* and Egyptian 4-rowed the pustules were larger than in the controls exposed to the light, while in susceptible varieties the infected areas were of an undiluted green in the midst of the surrounding chlorotic tissues. Uredospore germination and barley leaf infection took place at a relative humidity range from 72·5 to 100 per cent. It is apparent from these data that strict precautions should be taken for the maintenance of uniform environmental conditions in studies on physiologic specialization in *P. anomala*.

Dimitrieva (Mme T. I.). **The main results of breeding work at the Kharkoff Station.**—*Breed. Seed Gr.*, *1938*, 12, pp. 4–7, 1938. [Russian. Abs. in *Plant Breed. Abstr.*, ix, 3, p. 308, 1939.]

Among the most promising of the hybrid barley selections developed at Kharkoff [Ukraine] are the progeny of crosses between Nutans 0353/133 and Medicum 026, Medicum G. 78, and Nudum 25–5, all of which combine high resistance to *Helminthosporium* [*gramineum*: *R.A.M.*, xvi, p. 165] with various desirable commercial qualities.

Soukhoff (K. S.) & Vovk (A. M.). 'Закукливание' Овса, его вредоносность и пути распространения в природе. [The injuriousness of 'zakooklivanie' of Oats and the mode of its dissemination in nature.]—*Bull. Acad. Sci. U.R.S.S.*, *1939*, Sér. biol., 1, pp. 121–144, 6 figs., 1 diag., 1939.

This is an expanded account of work at Omsk on the mosaic disease of oats, called 'zakooklivanie' [pupation] disease, most of which has already been noticed in this *Review* [*R.A.M.*, xviii, p. 297]. Attempts to transmit the disease by sap inoculation and grafting gave negative results, and no evidence was obtained of its transmission through the soil or by seeds. The disease seemed to be least serious in oats sown in dense rows and at the end of May precisely.

Hoffmann (W.). **Neuere Untersuchungen über die Ursache der Urbarmachungskrankheit und die Wirkung des Kupfers als Spurenelement.** [Recent investigations on the cause of reclamation disease and the effect of copper as a trace element.]—*Bodenk. u. PflErnähr.*, N.F., xiii, 3–4, pp. 139–155, 2 figs., 1939.

Further proof was afforded by the writer's experiments at the Prussian Moorland Experiment Station, Bremen, of the indispensability of copper in the prevention and control of reclamation disease of oats [*R.A.M.*, xviii, p. 613]. The same symptoms developed in plants in water cultures from which copper was rigorously excluded as are commonly observed in nature on the particular types of moorland soil conducive to the disease. Even the traces of copper present in ordinary distilled and tap water sufficed to exert a remedial effect. The plants also responded to the application of copper by way of the leaves. The reclamation disease symptoms were further induced when humic acid was added to sand treated with hydrochloric acid. The beneficial influence of protracted heating of the soil (7 to 10 days at 110° C.) on the course of reclamation disease was shown to be due to the increase of the water-soluble fraction of the copper by this process. It is apparent from these studies that copper, even in infinitesimal amounts, plays the part of a basic nutrient element in relation to the prevention of reclamation disease.

Nicolaisen (W.), Seelbach (W.), & Leitzke (B.). **Untersuchungen über die Bekämpfung der Heidemoorkrankheit mit Kupferschlacke.** [Investigations on the control of reclamation disease with copper slag.] *Bodenk. u. PflErnähr.*, N.F., xiii, 3–4, pp. 156–169, 5 figs., 1939.

A detailed, tabulated account is given of one year's experiments at the Kiel (Schleswig-Holstein) Institute for Fodder Crops in the control of reclamation disease of Victory oats [see preceding abstract] by the application to the sandy humus soil of copper slag at the rate of 9 doppelzentner [900 kg.] per hect., which proved fully equal or even superior in its beneficial action to the maximum dose of copper sulphate (100 kg. per hect.). In some cases slag at the rates of 300 and 600 kg. per hect. gave results equivalent to those obtained with 50 and 100 kg. copper sulphate. No adverse influence on the yellow lupin [*Lupinus luteus*] crop succeeding oats was exercised by the copper sulphate or slag treatments, which in fact tended to stimulate flowering and so to increase the yield of dry substance. Favourable effects were also produced by the copper slag treatment in supplementary tests on rye and mangolds. It is pointed out that these experimental data are not necessarily applicable at the present stage to slags in general. The exact composition of the product in use (supplied by the North German Refinery, Hamburg), is known: it contains, in addition to 0·41 per cent. copper, a number of other elements in appreciable amounts (e.g., 39·4, 45·33, 5·70, 1·90, 0·33, 0·50, and 2·56 per cent., respectively, of the silicon, ferrous, calcium, zinc, manganese, magnesium, and aluminium oxides), any or all of which may be requisite for the optimal development of the crops. A minute quantity of lead (0·14 per cent.) is also present, the potentially deleterious effect of which on human or animal foods requires further investigation.

STEENBJERG (F.) & BOKEN (E.). **Karfosøg til Belysning af nogle Havresorters Gødskning med Mangansulfat.** [Pot experiments for the elucidation of the manganese sulphate fertilizing of certain Oat varieties.]—*Tidsskr. Planteavl*, xliii, 5, pp. 819–829, 4 figs., 1939. [English summary.]

The seven varieties of oats used in pot experiments in 1936 to determine the relationship between reaction to grey speck and soil treatment with manganese sulphate [*R.A.M.*, xvii, pp. 82, 586; cf. also xviii, p. 88] fell into two groups, viz., three with light-coloured kernels, White Odal, Eagle, and Victory, which are very susceptible to the disease, and four relatively resistant with dark kernels, namely, Mesdag, Fyris, Bell, and Lyngby Heath. The manganese content of the ripe plants was found on analysis to be somewhat lower in the resistant than in the susceptible group, the averages detected in the kernels of the three yellow or white varieties in pots receiving 0, 0·25, and 2 gm. manganese sulphate being 11·7, 14·1, and 25·7 mg., and in the straw 18·5, 17·6, and 17·7 mg., respectively, the corresponding quantities for the black or grey being 10·9, 13·8, and 25·9, and 16·2, 16·1, and 15·8, respectively. The correlation between absorbed and added manganese, i.e., the coefficient of uptake, was found to be identical, practically speaking, in both groups, but the correlation between the yield of dry substance and absorbed manganese (coefficient of utilization) is highest in the resistant group receiving no additional manganese and declines with increasing supplies of manganese sulphate to the soil. The experiments further showed that during the first year (probably two or three years in the field), the proportion of manganese absorbed from a normal supply of manganese sulphate is only 3 to 4 per mille. The amount of manganese withdrawn from the soil by leaching out being inconsiderable, it is obviously necessary to devise some method of rendering the element physiologically available to the plants.

POHJAKALLIO (O.). **Resistensförädling mot Ustilago hos Havre.** [Breeding Oats for resistance to *Ustilago*.]—*Nord. JordbrForskn.*, *1938*, 4–7, pp. 516–525, 1 fig., 1938.

In inoculation experiments with *Ustilago avenae* on 18 varieties of oats at Jokioinen, Finland [*R.A.M.*, xvii, p. 309], in 1936 and 1937, Petkus Yellow and 094 (President) showed 1·1 and 1·2 per cent. infection, respectively, in the former year and remained immune in the latter, when 028 (Alahärmä) and Lischow Early were also free from attack. Low percentages of infection (2 and 2·7, respectively) were further shown by S. 171 (*Avena strigosa* × *A. brevis* from England) and Pflug's Early in 1937, while the other varieties all contracted the disease in a severe form in one or both years, with infection percentages ranging from 47·3 to 92·9 per cent. A number of crosses were also susceptible in both years, whereas Petkus Yellow × 094, tested in 1937, developed only 6·8 and 5·9 per cent. infection (two inoculations). In tests to determine the influence of the host on the pathogenicity of the smut, the infection percentages on Nidar, Guldregn, and Pellervo with inoculum from Nidar were 98·7, 57·1, and 60·6; with mixed inoculum from the same three varieties and others, 71·4, 78, and 76·9; and from other varieties, 64·2, 69·1, and 63·4.

VOSS (J.). **Zur Prüfung der Resistenz von Hafersorten gegen Flugbrand (Ustilago avenae [Persoon] Jensen).** [On the testing of Oat varieties for resistance to loose smut (*Ustilago avenae* [Persoon] Jensen).] —*Z. Zücht. A.*, xxiii, 1, pp. 20–46, 4 figs., 1 map, 1939.

A fully tabulated account is given of the writer's experiments at the Biological Institute, Dahlem, Berlin, covering the three-year period 1936 to 1938 on the varietal reaction of oats to loose smut (*Ustilago avenae*) [see preceding abstract], using Reed's method of testing [*R.A.M.*, x, p. 652; xviii, p. 304]. The discrepancies between greenhouse and field results observed in a number of cases are not considered to detract from the efficiency of the technique; infection almost invariably tended to be more severe under glass than in the open, and judgements on varietal reaction may therefore safely be based on individual performance under the former conditions.

Most of the loose smut collections (111 in all) originating in different parts of Germany during the period of the trials were only mildly pathogenic to the standard assortment of seven varieties used (Carsten's V, Krafft's Rhenish Yellow, Halle selection 2817, v. Lochow's Yellow, Strube's Schlanstedt Yellow, Lischow Early, and Rotenburg Black), with the exception of the highly susceptible Strube's Schlanstedt Yellow. Nine collections (Nos. 8, 23 to 26, 28, 36, 46, and 54) caused heavy damage on all varieties except Rotenburg Black and Halle selection 2817, which were also resistant (together with Carsten's V) to 38 and 51. No consistent correlation could be traced between the virulence of the collections and their geographical situation. Of the 41 varieties tested for their reaction to varying numbers (up to 59) of the collections during the three years of observation, two were adjudged to be fully resistant (Rotenburg Black and Black President) and six partially so, viz., Anderbecker, Carsten's V, Endress Franken, Krafft's Rhenish Yellow, Lischow Early, and v. Lochow's Yellow. Of 25 selections tested in 1937 and 15 in 1938, 25 and 33 per cent., respectively, were fully or partially resistant. These data are regarded as presenting hopeful possibilities of combating the weak physiologic races of *U. avenae* predominating in Germany by a rational breeding programme.

HOPPE (P. E.). **Relative prevalence and geographic distribution of various ear rot fungi in the 1938 Corn crop.**—*Plant Dis. Reptr*, xxiii, 9, pp. 142–148, 2 graphs, 1939. [Mimeographed.]

The 1938 platings on potato dextrose agar of samples of damaged maize kernels taken from car-loads at terminal markets in the United States [*R.A.M.*, xviii, p. 17] yielded an unusually high proportion of *Diplodia zeae* [ibid., xvii, p. 811; xviii, p. 307] over a wide geographic range, the incidence of infection ranging from 0·3 per cent. in the west to nearly 60 in the east-central States. *Fusarium moniliforme* [*Gibberella fujikuroi*] and *F. moniliforme* [*G. fujikuroi*] var. *subglutinans* predominated in material from the southern, west-central, and western States, infection ranging from 12·7 per cent. (east-central) to 75 (Kansas and Nebraska). *G. saubinetii* was responsible for nearly 20 per cent. of the damage in the Atlantic coast States, and was also prevalent in southern Wisconsin and northern Illinois. *Nigrospora sphaerica* [ibid., xviii,

p. 18] was of little importance, the maximum of 3·5 per cent. occurring in Minnesota. As in 1937 [loc. cit.] the ratio of *Aspergillus* to *Penicillium* increased sharply in the comparatively dry western and south-western regions.

Notes are given on some regional differences in the fluctuations in the incidence of maize ear rots, illustrating the need for the accumulation of many years' data as a basis for serviceable conclusions regarding the relative prevalence of the various fungi concerned.

RHOADES (M. M.) & RHOADES (VIRGINIA). **Genetic studies with factors in the tenth chromosome in Maize.**—*Genetics*, xxiv, 2, pp. 302–314, 1 pl., 1 diag., 1939.

Linkage data are presented which place the gene (designated *Rp*) for resistance to physiologic race 3 of maize rust (*Puccinia sorghi*) [*P. maydis*] in seedlings from New York at the extreme end of chromosome 10 (comprising 84 units) [*R.A.M.*, xiv, p. 626], the sequence and intervening map distance of six other genes being given.

KERNKAMP (M. F.). **Genetic and environmental factors affecting growth types of Ustilago zeae.**—*Phytopathology*, xxix, 6, pp. 473–484, 2 figs., 1939.

The relative effects of genetic and environmental factors in the determination of the three growth types of maize smut (*Ustilago zeae*), viz., (*a*) strict sporidial, (*b*) fairly strict mycelial, and (*c*) intermediate, were studied at the Minnesota Agricultural Experiment Station [*R.A.M.*, ix, p. 713].

Type (*a*) could not be induced to form mycelium under any of the experimental conditions tested. Type (*b*) reacted to the admixture with the synthetic solution of 0·02, 0·5, or 1·5 per cent. asparagin or of 0·02 per cent. magnesium sulphate or potassium phosphate by the production of a few sporidia, which also followed the repeated supply of fresh nutrients. A similar but rather more active response to these stimuli was given by type (*c*). The growth types of the various lines of the smut used in the tests were not influenced by temperature, the hydrogen-ion concentration of the medium, or the development of 'staling' products. Segregation of factors for the sporidial and mycelial growth types occurred on individual promycelia in a sporidial × mycelial cross on a 4:0, 3:1, and 2:2 basis, denoting the existence of two or more factors for both sporidial and mycelial forms, of which only the latter is slightly susceptible to the operation of external influences.

BOEWE (G. H.). **Diplodia ear rot in Illinois cornfields.**—*Trans. Ill. Acad. Sci.*, xxxi, 2, pp. 92–93, 1938. [Received July, 1939.]

During the period from 1928 to 1937 the average incidence of maize ear rot (*Diplodia zeae*) [see preceding page] in Illinois was 1·25 per cent. (0·14 per cent. in 1937 to 5·88 per cent. in 1930). In five of the ten years the percentage of ears with visible infection was above the average and in the other five below it. In 1931, 1936, and 1937 dry rot was found in less than 45 per cent. of the fields examined (only 12·7 per cent. in 1937). During the ten-year period 1·12 per cent. of the northern fields were infected, the corresponding figures for the central and

southern regions being 1·33 and 1·19, respectively. Infection by *D. zeae* is known to result from spores produced in old stalks and conveyed for distances of up to 350 ft. by the wind, so that the disease is likely to be most prevalent in the chief maize-growing regions, providing an abundance of inoculum from the previous season. The low incidence of ear rot in 1937 is attributed to the increase in hybrid maize acreage, viz., 15 per cent. or five times as much as was planted in 1936.

B[AKER] (R. E. D.). **Mycological note.**—*Trop. Agriculture, Trin.*, xvi, 5, p. 110, 1939.

In October, 1934, West Indian and T.I. limes growing in a nursery in a wet locality in Trinidad became infected by *Phytophthora parasitica*, which attacked and killed the soft green tissues of the young scions [cf. *R.A.M.*, xviii, p. 103]. The infected plants were destroyed, and the disease disappeared with the onset of the dry season. If citrus nurseries are supplied with excessive shade, heavy damage may result in wet weather.

TZERETELI (L. Y.) & TCHANTURIA (N. N.). Болезни плодов Цитрусовых при хранении. [Diseases of Citrus fruits in storage.]—*Sovetsk. Bot.*, *1939*, 3, pp. 111–115, 1939.

Under conditions of storage in the Georgian Socialist Soviet Republic (average temperature 4° to 5° C. and relative humidity of 85 to 88 per cent.) the following organisms were found causing rot in citrus (most of them recorded for the first time in Georgia): *Phytophthora* sp., *Rhizopus* sp., *Trichoderma lignorum*, *Aspergillus niger*, *A. glaucus*, *Penicillium italicum*, *P. digitatum*, *P. crustaceum*, *Sphaceloma fawcettii* [*Elsinoe fawcetti*], *Diaporthe citri*, *Phoma citricarpa* [*R.A.M.*, xvii, p. 742], *P. hesperidum*, *Septoria citri* [ibid., xvii, p. 311], *Colletotrichum gloeosporioides*, *Botrytis cinerea*, *Trichothecium roseum*, *Cladosporium herbarum*, *C. brunneoatrum*, *Alternaria citri*, *Fusarium poae* [ibid., xvii, p. 250], *F. sublunatum*, *F. sambucinum* f. 2 [ibid., xvi, p. 601], *F. anguioides*, and *Bacterium* [*Pseudomonas*] *citriputeale* [ibid., xviii, p. 445]. From observations made in the packing-houses at least 50 per cent. of the rotting was due to *Penicillium italicum* and 30 per cent. to *Botrytis cinerea*. According to data obtained from a phytopathological analysis during storage *P. italicum* was responsible for 60 to 70 per cent. of the rotted fruit and *P. digitatum* only for 5 per cent., although the latter was more active than the former in artificially infected fruit. Of all antiseptics tested an 8 per cent. solution of borax (exposure for five minutes at 41° to 43°) was the most effective in reducing the losses from *P. italicum* and *P. digitatum* [ibid., xvi, p. 602] but had little effect on those caused by other fungi.

FAWCETT (H. S.). **Scaly bark in relation to propagation of Citrus trees.**—*Calif. Citrogr.*, xxiv, 7, pp. 242–262, 1 fig., 1939.

The author cites several examples as evidence that psorosis of citrus in California [*R.A.M.*, xviii, p. 518] is spread by budding rather than from tree to tree in the orchard. None of the 350 Navel orange trees in a block at the Citrus Experiment Station, all propagated from the disease-free tree 'Abe Lincoln', showed psorosis [in 1939] though five Valencia orchards in Orange county, experimentally budded from a

diseased orchard, were totally infected. In Ventura county a block of Valencias budded from a diseased parent exhibited 97 per cent. psorosis on the bark and 100 per cent. in the leaves, whereas next to it a block budded from a healthy parent had no psorosis. Lemons, as a rule, are stated to be more tolerant of psorosis than oranges, yet they are often badly affected, especially on sweet orange stock. A scheme for the registration of disease-free trees, suitable for purposes of propagation, has been initiated by the California Department of Agriculture, the essential requirements for registration being that orange trees are at least 15 years of age, have been thoroughly examined by an inspector for the absence of symptoms, and are growing sufficiently distant from diseased trees; in the case of lemon trees, at least ten buds must have been budded on at least five sweet orange stocks without producing symptoms of the disease.

BITANCOURT (A. A.). **Antracnose do Limoeiro Galego.** [Lime anthracnose.]—*Biologico*, v, 3, pp. 52–54, 1 pl., 1939.

A brief account is given of lime anthracnose (*Gloeosporium limetticolum*) [*R.A.M.*, xvi, p. 784], which is stated to cause severe losses in certain districts of Brazil.

BITANCOURT (A. A.). **A ascoquitose dos Citrus.** [The ascochytosis of *Citrus*.]—*Biologico*, v, 5, pp. 94–95, 1 pl., 1939.

Sweet and sour oranges, Sicilian lemons, tangerines, and pomelos are stated to be susceptible in São Paulo, Brazil, to infection by *Ascochyta citri* [*R.A.M.*, xiii, p. 90], the entrance of which into the epidermal tissues is facilitated by insect (*Melipona*) injuries. The fungus produces dark lesions of regular contour on the leaves and branches, the latter sometimes being completely girdled and dying off above the site of invasion.

ANAGNOSTOPOULOS (P. T.). *Ἡ παρακμὴ τῶν Κιτρεῶν τῆς Κρήτης, αἴτια, μέσα προλήψεως καὶ θεραπείας.* [The decline of the Citron in Crete, cause, means of prevention, and cure.]—*Hort. Res., Athens, 1939*, 2, pp. 99–112, 5 figs., 1939. [English summary.]

Among the causes of the recent decline of the Cretan citron (*Citrus medica*) crop to a quarter of its normal production are stated to be gummosis (*Phytophthora*), root rot (*Armillaria mellea*), wither tip (*Colletotrichum gloeosporioides*), *Deuterophoma tracheiphila* [*R.A.M.*, xviii, p. 245], *Diplodia* sp., *Phomopsis* [*Diaporthe*] *citri*, *Phoma* sp., and *Bacterium* [*Pseudomonas*] *syringae* [ibid., xvii, p. 812], the symptoms and control of which are fully discussed.

CAMP (A. F.) & PEECH (M.). **Manganese deficiency in Citrus in Florida.** —*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 81–85, 1 fig., 1939.

Manganese deficiency symptoms on citrus growing in the field in Florida [cf. *R.A.M.*, xvi, p. 313; xvii, p. 519] take the form of a network of fine green veins on a light green background on the young, unfolding leaves. At this stage it is difficult to distinguish the symptoms from those of zinc deficiency. When the leaves have just become fully expanded light green areas are found between the main veins and dark

green areas along the veins. The pattern is much less definite in colour and form than that caused by zinc deficiency, and as the leaves harden it may disappear. If it persists throughout the life of the leaf, the light green areas assume a light bronze colour later fading to dull white or dull light green. This dullness is a distinguishing characteristic of the condition. Affected leaves do not develop narrowing as in zinc deficiency, and there is no bushy growth with very short internodes. In severe cases growth and foliage are reduced and affected trees generally produce light-coloured fruit. If zinc and manganese deficiency are both present on the same tree and the former predominates the symptoms of the latter may be almost completely masked; if the latter predominates, its symptoms are intensified and are likely to be mistaken for those of zinc deficiency.

Spraying in spring and summer with manganous sulphate and hydrated lime or lime-sulphur gave excellent results in under 30 days. Alkaline coastal soils should be treated yearly, in January or early February, with an application of manganese sulphate (65 per cent.) at the rate of 5 lb. per tree.

Russo (G.). **Italy: the 'fetola' or yellow spot of Citrus in Sicily.**—*Int. Bull. Pl. Prot.*, xiii, 5, pp. 106M–108M, 2 figs., 1939.

Attention is drawn to the alarming spread of 'fetola' or yellow spot of oranges in Catania and other parts of Sicily [*R.A.M.*, xviii, p. 307]. In some localities the reduction in yield of healthy oranges in the current season's crop is estimated at a fifth or even a quarter of the total. The circular or irregular, slightly concave spots, each from a few millimetres to several centimetres in extent, may number 40 or more per fruit. They present a dotted aspect, owing to the presence of oil-bearing glands which are not attacked. The penetration of air into the interglandular spaces causes desiccation of the oil and imparts a sulphur-yellow tinge to the tissues and a reticulate appearance to the spots. The disease generally begins in September and reaches a climax during the succeeding months. A similar disorder is stated to be prevalent in California, where it is known as 'fruit-spotting' and attributed to the attacks of *Empoasca fabae*. The same agent is probably responsible for the trouble in Sicily, especially in view of its prevalence near cotton fields. Control measures are briefly indicated.

Miller (E. V.) & Schomer (H. A.). **Physiological studies of Lemons in storage.**—*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 432–434, 1939.

When green California lemons were stored at 32°, 36°, 40°, 50°, and 60° F. for 15 weeks and chemical analyses made of the peel and flesh of representative fruits before, during, and after storage, no relationship was found between sugar, acid, glucosides, and acetaldehyde, and the incidence of physiological disorders, but low reductase activity was shown by the peel of fruits stored at temperatures most conducive to pitting (40°, 36°, and 32°) [*R.A.M.*, xvii, p. 389].

Srinivasan (K. H.). **Progress Report of work done on the Coffee Experiment Station, Balehonnur, for the period 1932 to 1936.**—*Bull. Mysore Coffee Exp. Sta.* 18, 13 pl., 1 map, 1939.

In this report [cf. *R.A.M.*, xii, p. 435] the work of the Balehonnur

Coffee Experiment Station, Mysore, India, during the period 1932 to 1936 is briefly reviewed.

VASUDEVA (R. S.) & RAFIQUE (M.). **Studies on the root-rot disease of Cotton in the Punjab. VI. Chemical composition of healthy and diseased Cotton plants.**—*Indian J. agric. Sci.*, ix, 2, pp. 331–342, 1939.

Further studies on cotton root rot [*Macrophomina phaseoli* and *Corticium solani*: *R.A.M.*, xviii, p. 249] in the Punjab showed that reducing sugars and sucrose were higher in the roots, stems, and leaves of wilted plants than they were in the corresponding parts of healthy cotton growing in the same field. Total and ammoniacal nitrogen, iron, and the calcium to potassium ratio were significantly higher in diseased than healthy roots. The ratios of iron in the leaf to iron in the root, and of calcium in the leaf to calcium in the root were lower in diseased than in healthy plants. The ratio of potassium in the leaf to potassium in the root, on the other hand, was higher in diseased than in healthy cotton.

PELTIER (G. L.), SCHROEDER (F. R.), & WRIGHT (E.). **Distribution and prevalence of Ozonium root rot in the shelterbelt planting area of Oklahoma.**—*Phytopathology*, xxix, 6, pp. 485–490, 1 fig., 2 maps, 1939.

Using the methods described by the senior author for the determination of the distribution and prevalence of root rot (*Phymatotrichum omnivorum*) in the shelter-belt zone of Texas [*R.A.M.*, xvi, p. 454; xviii, p. 590], the writers conducted a detailed survey of part of a similar planting area in south-western Oklahoma, and here discuss their progress up to August, 1938. A sharp line of demarcation between infested and non-infested areas was a feature of the surveys in both States, possibly associated with temperature and soil factors. For instance, the northward extension of the rot to the foothills of the Wichita Mountains, Oklahoma, may be attributed to the protection afforded by these ranges from cold north winds. A correlation was further observed between types of natural vegetation and the incidence of *P. omnivorum*. Another outstanding characteristic of root rot is its tendency to accumulate from the headwaters of a creek down the drainage basin, as in Deep Red Creek, Oklahoma. The futility of clearing native infested areas for diversified farming has become obvious in both States. It is evident that surveys for root rot should be made before replanting shelter-belts, so that infested areas can be avoided or planted to resistant crops.

PRESLEY (J. T.). **Unusual features in the behaviour of sclerotia of Phymatotrichum omnivorum.**—*Phytopathology*, xxix, 6, pp. 498–502, 2 figs., 1939.

In contrast to the sclerotia produced by many fungi, those of the cotton root rot fungus, *Phymatotrichum omnivorum* [see preceding abstract], seem capable of reproducing the fungus from every cell by a process of 'vegetative sprouting'. The new hyphae appear to be formed inside the cells, whose contents go through a process of disorganization and reorganization that results in the formation of new hyphae,

each of which can produce a mycelium. The following is the sequence of events within the cells. Complete nuclear disorganization is succeeded by the convergence of two of the dark-staining bodies (possibly nucleoli) scattered throughout the cells, coinciding with localized increased density of the cytoplasm and ultimately giving rise to the formation of hyphae, which break through the 'mother' cell wall. Some of the hyphal tips on emergence from the sclerotial shell have peculiar branches or appendages which soon become detached. The newly formed hyphae are multinucleate and agree in all particulars with those of the actively growing vegetative mycelium, imparting to the sclerotium the setose aspect typical of the germinating stage of the fungus.

KHAN (H.). **Notes on the diseases of Trout at the Mahili hatchery—Kulu (Punjab).**—*J. Bombay nat. Hist. Soc.*, xl, 4, pp. 653–656, 1939.

Excellent control of the disease caused by *Saprolegnia* [*R.A.M.*, xviii, p. 591] on trout and carp in the Punjab is stated to have been obtained by placing the fish for five to ten minutes, or until signs of distress are shown, in a salt bath (3 per cent. sodium chloride). Patches of skin overgrown by the fungus may be gently rubbed with cotton soaked in a 1 in 2,000 copper sulphate solution or common salt in vinegar or iodine.

DESCHIENS (R.). **Capture et destruction de larves de Strongylidés du Singe et du Bœuf par des Hyphomycètes.** [The capture and destruction of Strongylid larvae of the Monkey and Ox by Hyphomycetes.]—*Bull. Soc. Path. exot.*, xxxii, 4, pp. 394–398, 1939.

Further details are given of experiments in the capture and ingestion of nematodes by the predacious fungi *Dactylella bembicodes* and *Arthrobotrys oligospora* [*R.A.M.*, xviii, p. 520 and next abstracts], the larvae in the cases under discussion being *Oesophagostomum bifurcum* from the cynocephalous monkey (*Papio sphinx*) and Strongylidae from a calf. An abundant spore yield may be obtained from agar cultures in moist chambers in 10 to 15 days.

DESCAZEAUX (J.). **Action des champignons Hyphomycètes prédateurs sur les larves de certains Nématodes parasites des ruminants.** [The action of Hyphomycetous fungi preying on the larvae of certain Nematodes parasitic on ruminants.]—*Bull. Soc. Path. exot.*, xxxii, 5, pp. 457–459, 1939.

Evidence is presented showing that *Arthrobotrys oligospora* and *Dactylella bembicodes* [see preceding and next abstracts] are capable of capturing and consuming the larvae of the Trichostrongylidae infesting the alimentary canal of oxen and sheep, and it may be confidently assumed that the Metastrongylidae of these ruminants undergo ingestion in a similar manner.

DESCHIENS (R.). **Considérations relatives à la destruction des larves de Nématodes parasites par des Hyphomycètes prédateurs.** [Considerations relative to the destruction of the larvae of parasitic Nematodes by predacious Hyphomycetes.]—*Bull. Soc. Path. exot.*, xxxii, 5, pp. 459–464, 1939.

The writer summarizes and brings up to date the progress made in the practical application of the predacious fungi, *Arthrobotrys oligospora*,

Dactylella bembicodes, and *D. ellipsospora* to the capture and destruction of the larvae of nematodes of domestic animals [see preceding abstracts]. Aspects of the subject to be taken into consideration include the accumulation of sufficient spore material for large-scale treatment of infested fields and the possibilities of injurious effects of such inoculum on man, livestock, or the soil.

Blunck (H.). **Natürliche Feinde und biologische Bekämpfung der Maikäferengerlinge.** [Natural enemies and biological control of Cockchafer larvae.]—*Z. PflKrankh.*, xlix, 5, pp. 338–381, 7 figs., 1939.

The writer summarizes and discusses the available information on the natural enemies of the cockchafer (*Melolontha melolontha*), among which are a number of fungi, including *Beauveria densa* [*R.A.M.*, xviii, p. 453]. *B. densa* has been reported in the literature on cockchafers from France, Germany (with Austria), Denmark, Sweden, Norway, Poland, U.S.S.R., Hungary, and Italy. Although there is no doubt that the fungus may decimate the larval populations of cockchafers under natural conditions, and epidemics have in fact recently been recorded in various parts of Germany, the writer is sceptical of its potentialities for artificial control on any considerable scale.

Kuhn (L. R.). **Growth and viability of Cryptococcus hominis at Mouse and Rabbit body temperatures.**—*Proc. Soc. exp. Biol., N.Y.*, xli, 2, pp. 573–574, 1939.

Mice were readily infected at the University of Chicago with strains of *Cryptococcus hominis* [*Debaryomyces neoformans*] isolated from human cases of *Torula* meningitis, subcutaneous tumour, and generalized infection [*R.A.M.*, xviii, p. 592]. Death occurred following a regular increase in the number of viable yeasts in the mouse organs, especially the brain and lungs. On the other hand, rabbits resisted infection and the number of viable yeasts steadily decreased. Six strains of group (3) cryptococci [ibid., xv, p. 153] isolated from man were grown on dextrose veal infusion broth (P_H 7) at temperatures between 99° and 107° F. At the higher temperatures fewer organisms were produced and the viable cells decreased in number (in one instance from 7,480 per cu. mm. after eight days at 99° to 0 at 107°). The optimum for *D. neoformans* would appear to be below the normal body temperature of either of the experimental animals (99·1° in mice and 103·15° in rabbits); in the case of rabbits there was a rise to 105° to 107° after injection with the fungus.

Reyer (W.). **Über die Vermehrung von Blastocystis in der Kultur.** [On the reproduction of *Blastocystis* in culture.]—*Arch. Protistenk.*, xcii, 2, pp. 226–244, 2 figs., 1939.

The author, on the basis of studies at the Karlsruhe (Germany) Institute of Tropical Hygiene, distinguishes three types of human *Blastocystis* [*R.A.M.*, xvii, p. 816], of which I corresponds to *B. hominis* [ibid., xvii, p. 111] and II and III to *B. gemmagina*. Monkeys also harboured types I and (?) II, whereas only the former was detected in rats and pigs. At 37° C. on a medium of 2 per cent. agar on which were

superimposed layers of (*a*) horse serum and buffered Ringer solution at P_H 7·5, and (*b*) paraffin oil, type I is characterized by small, mostly spherical elements, the largest seldom exceeding three or four times the diameter of the smallest, reproducing by binary fission or simple budding; II by large, mostly spherical bodies, the largest often far more than four times the size of the smallest, reproducing chiefly by multiple budding but sometimes as in I; and III by large, frequently much branched structures, reproducing mainly by budding, the buds often tapering at the site of abstriction. The multiple budding described by Schaudinn in connexion with *Entamoeba histolytica* is attributed (*Arb. Kaiserl. GesundhAmt.*, xix, p. 597, 1903) to confusion with *Blastocystis* type II. Neither endosporulation nor copulation was observed.

The specific structure, cultural reactions, and extreme frequency of *Blastocystis* as an intestinal parasite of man are considered to leave no doubt as to its independent existence, but its classification in the natural system of fungi must be deferred pending the observation of sexual organs: meanwhile it should be placed among the Fungi Imperfecti.

KELLEY (W. H.). **A study of the cell and colony variations of Blastomyces dermatitidis.**—*J. infect. Dis.*, lxiv, 3, pp. 293–296, 1 fig., 1939.

The cell and colony characters of *Blastomyces* [*Endomyces*] *dermatitidis* [*R.A.M.*, xviii, p. 253] were found, in the writer's experiments at the Duke University (North Carolina) School of Medicine, to be strongly influenced by the agar concentration of the beef extract medium. Optimum growth was obtained on a substratum consisting of 3 gm. beef extract, 10 gm. peptone, 5 gm. sodium chloride, 10 gm. starch, 15 gm. agar, 5 to 10 per cent. fresh rabbit or swine serum, and up to 1,000 c.c. water, with a hydrogen-ion concentration of P_H 7·2 to 7·3, the cultures being incubated at 37·5° C. in a humidor. Under these conditions the fungus developed in the form of elongated, cylindrical cells and produced colonies resembling those of the smooth mutants of bacteria and yeasts, growth being about twice as rapid as on the ordinary blood-agar medium. With a proportion of agar exceeding 2 per cent. the development of the fungus was typically mycelial.

FRASER (P. K.). **Some figures on the incidence of dermatophytosis.**—*J. trop. Med.* (*Hyg.*), xlii, 10, pp. 141–144, 2 figs., 1939.

After citing statistics in evidence of the world-wide upward trend in the incidence of mycotic infections, with special reference to the British Navy (in which dermatomycoses have been separated from skin diseases as a whole since 1930), the writer gives the results of cultural studies (carried out in collaboration with Miss F. L. Stephens) on 16 of the most severely infected cases of ringworm of the foot out of 319 (51·3 per cent. of the total) showing lesions. The fungi isolated from ten of the patients were *Trichophyton rubrum* [*R.A.M.*, xviii, p. 523], *T. interdigitale* [ibid., xviii, p. 313] (two), *Corethropsis hominis* [cf. ibid., xiv, p. 105], and *Epidermophyton floccosum* [ibid., xvii, p. 819; xviii, pp. 110, 311] (alone in one instance and in company with *Aspergillus* sp. and *T. gypseum*, respectively, in two others).

Zündel (W.). **Die europäischen Epidermophytonpilze.** [The European *Epidermophyton* fungi.]—*Arch. Derm. Syph., Berl.*, clxxix, 1, pp. 1–57, 36 figs., 1939.

This is a comprehensive account, based on personal observations at the Berlin Dermatological Clinic and a wide survey of the pertinent literature, of the clinical, morphological, and cultural features of the European species of *Epidermophyton*, viz., *E. inguinale* [*E. floccosum*: see preceding abstract], *E.* [*Trichophyton*] *interdigitale* [loc. cit.], and *E.* [*T.*] *rubrum* [loc. cit.] (comprising the forms variously described as *E. plurizoniforme*, *E. lanoroseum*, and *T. pedis*) [*R.A.M.*, xvii, p. 818].

Grigoraki (L.). & David (R.). **Caractères biochimiques de Trichophyton lacticolor (Sabouraud, 1910).** [Biochemical characters of *Trichophyton lacticolor* (Sabouraud, 1910).]—*C. R. Soc. Biol., Paris*, cxxxi, 19, pp. 767–769, 1939.

Trichophyton lacticolor [*R.A.M.*, xvii, p. 746] was shown to possess a very active casease, peptonizing 10 c.c. milk in less than a fortnight, and a vigorous trypsin, the liquefaction of gelatine being accomplished in 36 days. The most pronounced colorimetric changes in the carbohydrates and glycerine solutions tested occurred after ten days, after which there was a gradual attenuation. The alterations were not remarkable, except in the case of mannose, which turned from violet-red to orange 101, and glycerine (purple 531).

Grigoraki (L.) & David (R.). **Caractères biochimiques d'Endodermophyton indicum (Castellani, 1911).** [Biochemical characters of *Endodermophyton indicum* (Castellani, 1911).]—*C. R. Soc. Biol., Paris*, cxxxi, 18, pp. 594–596, 1939.

Continuing their studies on the biochemistry of the dermatophytes [*R.A.M.*, xviii, p. 522], the writers found that the casease of *Endodermophyton indicum* [*Trichophyton concentricum*: ibid., xviii, p. 524] is relatively inactive, the period required for peptonization being 85 days, whereas its trypsin acts vigorously and rapidly, the liquefaction of an 18 per cent. gelatine solution commencing a few hours after inoculation; in this respect the fungus resembles *Achorion violaceum*. The intensive assimilation of glycerine is not, however, accompanied by a proportionate increase of growth, the diameter of the cultures after 60 days being only 48 mm. There were no striking colorimetric changes in the carbohydrate and glycerine solutions in which *T. concentricum* was grown at 35° C., another point of likeness to *A. violaceum*.

Catanei (A.) & Grenierboley (J.). **Étude de teignes de la peau observées au Tonkin.** [A study of the skin ringworms observed in Tonkin.]—*Arch. Inst. Pasteur Algér.*, xvii, 2, pp. 282–285, 1 pl., 1939.

Clinical details are given of four cases of ringworm in Tonkin, Indo-China, in males aged 25, 37, 17, and 21 years, two of which were due to *Trichophyton concentricum* [see preceding abstract] and two to *T. rubrum* [*R.A.M.*, xviii, p. 523]. Positive results were given in inoculation experiments with both organisms on monkeys (*M*[*acacus*] *inuus*) and guinea-pigs.

Henrici (A. T.). **An endotoxin from Aspergillus fumigatus.**—*J. Immunol.*, xxxvi, 4, pp. 319–338, 1939.

This is an expanded account of the writer's studies at the University of Minnesota on the endotoxin isolated from a strain of *Aspergillus fumigatus* originating in a chicken, and experimentally shown to be pathogenic also to rabbits, guinea-pigs, and mice [*R.A.M.*, xviii, p. 109].

Harris (L. H.). **Allergy to grain dusts and smuts.**—*J. Allergy*, x, 4, pp. 327–336, 1939.

A series of 13 cases of respiratory allergy due to grain dusts and smuts in Ohio is described. All the patients reacted positively to intradermal injections of wheat and oat dust, 'musty' samples producing much stronger effects than 'clean' ones; the former contained three to five times as much nitrogen as the latter. In practically every case reacting to the dusts a similar response was obtained to one or more smuts. Seven out of the 13 persons under observation reacted positively to *Ustilago tritici* [*R.A.M.*, xvi, p. 381], 7 each to *Tilletia tritici* [*T. caries*] and *T. levis* [*T. foetens*: loc. cit.], 10 to *U. avenae* and *U. levis* [*U. kolleri*] (combined), 10 to *U. zeae* [ibid., xvii, p. 174; cf. ibid., xviii, p. 111], and 8 to *U. hordei*. Five of these patients also gave positive reactions to mould (*Alternaria*, *Helminthosporium*, *Chaetomium*, and *Hormodendrum*) spores [ibid., xviii, p. 254]. The symptoms were successfully reproduced by the instillation into the nostrils of untreated persons of concentrated grain dust and smut extracts.

Straib (W.). **Untersuchungen über den Wirtsbereich und die Aggressivität physiologischer Rassen von Melampsora lini.** [Studies on the host range and aggressiveness of physiologic races of *Melampsora lini*.]—*Züchter*, xi, 5, pp. 130–136; 6, pp. 162–168, 2 figs., 1939.

The method of inoculating flax cotyledons in the stage of incipient development was found to facilitate the determination of physiologic races of *Melampsora lini* [*R.A.M.*, xviii, p. 509] and of varietal reaction to the rust in the writer's experiments at the Gliesmarode (Brunswick) branch of the Reich Biological Institute.

Four physiologic races, differing in pathogenicity from those isolated by Flor in the United States [ibid., xvii, p. 530], were obtained from uredospore collections from Holland, Sweden, and Germany, while indirect evidence was also forthcoming for the occurrence of physiologic specialization among the South American strains. Two of the races tested (Swedish and German) attacked, in addition to *Linum usitatissimum*, its var. *crepitans*, *L. africanum*, *L. corymbiferum*, *L. floccosum*, *L. hirsutum*, *L. nervosum*, *L. pallescens*, and *L. tenue*. *L. tenuifolium* produced a moderately resistant type, while *L. narbonense* comprised both immune and susceptible varieties; 25 other species of *Linum* remained free from infection. The wild forms of flax occurring in Germany (except *L. tenuifolium*) do not appear to act as hosts of the specialized strain of the rust (var. *liniperda*) attacking *L. usitatissimum* [ibid., vii, p. 580]. Scarcely any of the cultivated fibre varieties except Weihanstephan 384 showed any appreciable degree of resistance to the four races of *M. lini* used in inoculation tests in the greenhouse at 18° C.,

though the Dutch race occasionally proved less virulent than the others. On the other hand, immunity from some or all the four races was exhibited by certain oil-yielding varieties, e.g., Buck 2/34, 3/34, 7/34, and 9/34, various forms of Estanzuela, Kenya C.I. 709, Klein Bh, M.A. 6903, Manchuria, Punjab, Red Wing C.I. 499, Sicily, Weimar (all blue-flowering), and the white varieties Alvarez Nieves, Argentine, Ottawa 770 B×Saginaw C.I. 687, and Ottawa 770 B×Winona C.I. 684. However, reference to Vallega's results in the Argentine [ibid., xvii, p. 530] shows that the South American varieties resistant to the European, North American, and Japanese races of the rust are susceptible to the Argentinian; evidently uniform resistance throughout the globe is very rare. Modifications were observed in the reactions of older plants towards the disease as compared with those of young material and seedlings.

Haasis (F. A.). **Studies on Narcissus mosaic.**—*Mem. Cornell agric. Exp. Sta.* 224, 22 pp., 2 pl. (1 col.), 1939.

Narcissus mosaic [*R.A.M.*, xvii, p. 684], referred to by various workers as 'grey disease', 'yellow stripe', 'broken', 'mottling', 't'grijs', and 'grauw' disease has been reported from Australia, England, Bermuda, Bulgaria, Holland, and the United States. The pattern on the leaf consists of light green to greyish-green or dull to bright yellow streaks parallel to the long axis of the blade. They may extend continuously from base to tip, but as a rule they are broken and coalesce into isolated islands approaching normal leaf colour. These symptoms are occasionally expressed only in the basal parts of the leaf, though often confined to the upper two-thirds. The two surfaces of an individual leaf may bear different patterns. Necrotic spots may be present, especially on the King Alfred variety. Distortion of the foliage is common; in King Alfred the leaves may be spirally twisted, while Victoria often shows a bend in the plane of the leaf. Epidermal roughening is another striking symptom; the Sir Watkin and Minister Talma varieties always show it, while in others it is less conspicuous. The roughened areas occur in narrow bands parallel with the blade, which, as a rule, coalesce, areas of considerable width thus becoming involved. In many varieties symptoms resembling those on the leaves occur also on the flower stems. On the perianth and cup the symptoms appear as opaque, frost-like streaks and blotches, or small, isolated spots. When the attack is severe, the greater part of these organs may be affected, but generally the perianth is more severely affected than the cup. The floral parts are occasionally distorted.

Diseased plants produce inferior flowers and bulbs. When practically healthy and mosaic stocks of the Sir Watkin variety were grown under comparable conditions for three consecutive years the percentage weight increases annually for the latter were, respectively, 58·3, 36·1, and 8·6 per cent., as against 73·9, 63·7, and 30·5 per cent. for the former.

Experimental evidence showed that the disease is caused by a virus transmissible by grafting parts of diseased bulbs on to healthy ones or by mechanically injecting or rubbing sap from leaves of diseased plants into or on leaves of healthy plants. Transmission by soil contamination or root contact is very improbable, and by root mutilation and cutting

or picking the flowers negligible. The virus does not appear to be transmitted through seed, but is perpetuated by the propagation of mosaic bulb stock.

Symptom expression varies widely with the variety, but inter-varietal inoculations indicate that the disease is probably due to a single virus. The virus resisted ageing *in vitro* for at least 72 hours, was transmissible at a dilution of 1 in 100, was inactivated at a temperature between 70° and 75° C., and failed to pass through Pasteur-Chamberland filters L_2, L_5, and L_7. Other plants than narcissi [including daffodils] appear to be very resistant to, or even immune from, infection with the narcissus virus. The best means of control consists in roguing and destroying affected plants, or protecting healthy ones from inoculation by means of cheese-cloth cages.

Longrée (Karla). **The effect of temperature and relative humidity on the powdery mildew of Roses.**—*Mem. Cornell agric. Exp. Sta.* 223, 43 pp., 4 figs., 9 graphs, 1939.

Investigations [which are fully described] into the effect of temperature and relative humidity on the conidial germination, mycelial development, and sporulation of *Sphaerotheca pannosa* var. *rosae* [*R.A.M.*, xvii, p. 771; xviii, p. 463] showed that the minimum, optimum, and maximum temperatures for germination were 3° to 5°, 21°, and 33° C., respectively. At 3° to 5° haustoria were occasionally noted on detached young leaves, but no further growth occurred; from 6° to 10° mycelium was scanty; between 11° and 28° there was good mycelial development, while optimum growth occurred between 18° and 25°. At 30° to 31° haustoria were occasionally found, but no further formation was observed at 33° to 34°. No sporulation occurred at temperatures below 9° to 10° or over 27° to 27·5°. The greatest number of spores per conidiophore was found at 21° to 27·5°, though at the latter temperature rather few conidiophores were present. High germinability was most quickly reached at 24° to 27·5°, but the longest period of high germinability on a given leaflet occurred at 18° to 19°. Changes in temperature did not stimulate germination. Germinability was approximately and entirely lost by exposure for 24 and 48 hours, respectively, to 0°. At 21° germinability decreased rapidly with decreasing relative humidity. In general this was also true at 33° to 34°, but the periods of viability were briefer and the effect of the relative humidity was overshadowed by the adverse influence of the high temperature. At relative humidities of 99·8, 99·0, 98·0, 96·9, and 94·9 per cent. (at 25·17°) the percentage conidial germination on glass slides was, respectively, 25·8, 66·2, 63·1, 67·7, and 2·0, while at relative humidities of under 75 per cent. (at 21°) no germination occurred. High germination is considered to be merely a matter of proper humidity.

In the case of conidia dusted on leaves of rose shoots in a controlled environment germination declined as the atmospheric humidity was decreased, temperature being constant, but in general the spores germinated in very dry atmospheres. Germination was higher on young than on old leaves of the same variety, and on the under than on the upper surface. The evidence indicated that the relative humidity at the surface of rose leaves is very high, even in a dry atmosphere.

On young leaves of two varieties decreasing relative humidity gave sparser mycelial development and fewer conidiophores, but both mycelial development and sporulation occurred even at 21 to 22 per cent. relative humidity. Old leaves of the susceptibile variety Excelsa were less susceptible than young leaves, and their upper surface less susceptible than the under surface. Old leaves of the Pernet variety were resistant under all conditions.

Davis (W. H.). **A bud and twig blight of Azaleas caused by Sporocybe azaleae.**—*Phytopathology*, xxix, 6, pp. 517–528, 1 fig., 1939.

Cultivated and wild azaleas (*Rhododendron* spp.) in Massachusetts are stated to be in danger of extermination by the bud and twig blight caused by *Sporocybe azaleae* [*R.A.M.*, xii, p. 696], the relationship of which to *Ceratostomella ulmi*, the agent of Dutch elm disease, is a matter of topical interest. Like *C. ulmi*, *S. azaleae* plugs the vessels with tyloses so that necrosis results. Other symptoms of the azalea disease (for which the designation 'bud and twig blight' is preferred to bud blight, rot, or blast) include dwarfing, discoloration, and shrivelling of the floral buds, prevention of blossoming (98 per cent. of affected flower buds failing to open, leaf buds being less susceptible to infection), and girdling of the stems: in some plantings 60 per cent. of the shrubs were killed by the disease. Initial infection from coremiospores occurred in the axils of the lower bud scales, whence the germ-tubes penetrated the meristematic bud cone and the hyphae advanced through the flower, bract, leaf, and stem tissues into the bark and pith cells filled with stored starch grains, and traversed the vascular system and cortical parenchyma.

S. azaleae made good growth and sporulated on cooked substrata containing starches and sugars, the optimum hydrogen-ion concentration and temperature being near $P_H 6$ and 22° to 25° C., respectively. The outer zone of the colonies on potato dextrose agar is light to mouse-grey, the inner (sporulating) area olive-coloured and of a felty consistency. In nature the coremia of the fungus develop in the autumn in the form of grey, hair-like stalks about 1 mm. in height, bearing at their apices grey, knob-like heads composed of grey coremiospores. Later the coremia turn dark brown, imparting a spiny appearance to the buds. These organs were also formed on inoculated capsules stored in damp chambers. In artificial inoculations the most successful results were obtained by placing the inoculum in the axils and outer scale cups of buds; wounds in the bark also afforded a favourable entry. Azaleas inoculated with *S. azaleae* lived for about five years, during the last of which, however, they mostly remained leafless with green bark. Of the eight *R.* spp. inoculated, *R. arborescens*, *R. viscosum*, *R. californicum*, *R. catawbiense*, *R. maximum*, and *R. molle* were resistant or immune, *R. nudiflorum* and *R. canescens* susceptible. In experiments conducted in 1933 and 1935 the fungus remained viable in the host during each month of the year. As long as the inner bark remained green and intact the fungus could be cultured from infected dead twigs. In bud inoculations it advanced into the stem from 3 to 5 mm. in the first year and up to a decimetre in the second. Inoculations made in August and September gave the best results.

Good control was obtained by the pruning and destruction of diseased material and dusting with copper-lime dust 57 or spraying with Bordeaux mixture 5-5-50.

POHLIG (M.). **Beobachtung über eine Pilzerkrankung an Alyssum saxatile.** [Observation on a fungous disease of *Alyssum saxatile.*] —*Blumen -u. PflBau ver. Gartenwelt*, xliii, 21, p. 246, 1939.

Peronospora galligena [a specialized form of *P. parasitica*: *R.A.M.*, xvii, p. 824] was found to be the agent of numerous hemispherical, convex, or concave protuberances on the leaves of *Alyssum saxatile* in the Dresden district of Germany in 1938.

DIEHL (W. W.). **Identity and parasitism of a species of Dothichloë.**—*J. agric. Res.*, lviii, 12, pp. 947–954, 1 pl., 1939.

Dothichloë limitata, formerly erroneously referred to *D. atramentosa* [*R.A.M.*, x, p. 389] but here established as a new species, is stated to occur on the leaves of various grasses, inducing sterility, in the south-eastern part of the United States and in North Dakota, also in Brazil, Surinam, and the West Indies. The fungus forms fructifications which are white at first and then black, up to 2 cm. in diameter on the upper leaf surface. The white stage bears conidia and is relatively conspicuous only when the leaves are distended, whereas the matured black ascostromata stand out plainly but finally slough off, leaving the leaf almost normal. Diseased plants are difficult to distinguish as the absence of inflorescences, the only readily recognizable symptom, easily passes unnoticed. The new species is described in Latin and English. The scolecosporous conidial fructifications are ephemeral, white to grey, with a palisade of conidia (18 to 30 by 1 to 2 μ), on short, simple conidiophores, rarely swollen and branched, sometimes coalescing to form a hymenium; amerosporous conidial fructifications, with simple to spatulate conidiophores, each with an apical sterigma bearing a single obovate conidium measuring up to 4 by 3 μ, develop under conditions of extreme moisture upon the immature ascostroma.

The ascostromata are uniformly effuse, maculiform, usually 10 to 15 mm. in diameter, sometimes separated into pulvinuli by sterile areas; the surface is uniform to rugulose, black, punctate from the slightly emergent ostioles; the context is white; and the perithecia are ovate to lageniform, 180 to 315 by 80 to 130 μ, the asci 105 to 160 by 4 to 6 μ, and the ascospores 90 to 120 by 1 to 1·5 μ. The new species is distinguished from *D. atramentosa* by the fact that it always occurs on the adaxial surface of the leaf, while *D. atramentosa* remains constantly abaxial. The results of inoculation experiments were unsuccessful, but observations in the field and greenhouse point to systemic infection. Low temperatures in the greenhouse (minimum of 7° C.) prevented the sporulation of the fungus but did not eliminate the infection. The effect of low temperatures may explain the predominantly southern distribution of the fungus, while in more northern regions it may be present in the grass tissue without producing any conspicuous symptoms.

Björling (K.). **Undersökningar rörande Klöverrötan. I. Infektionsförsök med Sclerotinia trifoliorum Eriksson. Förelöpande meddelande.** [Studies relating to Clover rot. I. Inoculation experiments with *Sclerotinia trifoliorum* Eriksson. Preliminary communication.]—*Medd. Växtskyddsanst., Stockh.*, 27, 24 pp., 2 figs., 1 graph, 1939. [German summary.]

Notwithstanding the fundamental difficulties [which are discussed] attendant on the differentiation of physiologic races of fungal pathogens on cross-pollinating plants, such as clover, the writer's inoculation experiments at Svalöv, Sweden, in 1938 with three isolates of *Sclerotinia trifoliorum* [*R.A.M.*, xviii, p. 628] on twelve strains of red clover [*Trifolium pratense*], including one each from Denmark and Germany, yielded the following information on the point in question.

The fungus was cultured on bread according to Rudorf's method [ibid., xvii, p. 185] and an aqueous suspension of the ground sclerotia plus 2 per cent. cane sugar and 0·5 per cent. agar inoculated into the plants on 1st and 15th July at 16° and 20° C., respectively. In the tests with the relatively mild Svalöv isolate the most resistant clover strains were two from Skåne (Harrie and Merkur) and one from Blekinge (Wambåsa), while the most susceptible were the German and two from north Sweden. Merkur was also very resistant to the more virulent isolates from Ultuna and Luleå. In a small-scale trial on four red clover clones with five isolates of *S. trifoliorum* individual differences in response were also detected, and the outcome of the experiments as a whole is considered to provide a basis for field observations on physiologic specialization within the fungus and variations in susceptibility to its attacks.

Klemm (M.). **Zur Kenntnis der wirtschaftlichen Bedeutung des Kleekrebses (Sclerotinia trifoliorum Eriks.) in Deutschland.** [A contribution to the knowledge of the economic importance of Clover stem rot (*Sclerotinia trifoliorum* Erikss.) in Germany.]—*Landw. Jb.*, lxxxvii, 6, pp. 839–893, 3 graphs, 19 maps, 1939.

The salient points of this exhaustive, fully tabulated and documented survey of the economic importance of clover stem rot (*Sclerotinia trifoliorum*) in Germany have already been noticed from another source [*R.A.M.*, xviii, p. 318].

Thomas (H. Earl) & Ark (P. A.). **Some factors affecting the susceptibility of plants to fire blight.**—*Hilgardia*, xii, 4, pp. 301–322, 2 figs., 1939.

In further studies on *Bacillus amylovorus* [*Erwinia amylovora*: *R.A.M.*, xiv, p. 702; xviii, p. 399] in California observations on the histology of the shoots of resistant and susceptible plants indicated that the size of the intercellular spaces is only a minor factor in determining the course of infection. Tissues with a high nitrogen content were more susceptible in general than the nearest comparable tissues with less nitrogen. Thus, for example, when 20 root-bound plants of *Pyracantha angustifolia* in pots of poor soil were selected in pairs and one of each pair received ¼ gm. of calcium nitrate, all the plants being inoculated at

the tip five days later, 13 days after inoculation the length of the blighted part averaged 5·9 in. for the treated plants and only 2·2 in. for the untreated. Other evidence suggested that the concentration of solutes in the nectar and perhaps in the plant sap, as affected by atmospheric humidity, is of importance in the penetration of the organism into the plant and the subsequent development of infection.

On girdled pear and apple trees the bark immediately above the point of girdling was more susceptible than that immediately below. Of 184 Yellow Newtown apple trees girdled on the upper trunks, 64 developed blight starting at the ring; 81 per cent. of the cankers spread farther above than below the ring, and 65 per cent. were confined to the bark above the ring, only 7 per cent. being entirely below. When inoculum was applied to the fresh girdling wounds on seedling pear trees, out of 37 infections 73 per cent. extended farther above than below the ring, and 24 per cent. were larger below the ring, the average length of the cankers being 3·27 in. above and 1·75 in. below the ring. The result of an experiment on *P. angustifolia* indicated that wounds became unfavourable to infection within 27 hours (0 out of 5 inoculations successful) and partially so in 6 hours (3 out of 15 successful compared with 18 out of 20 when inoculated on wounding). Tests for gums and suberins did not show the presence of these substances at the margins of wounds until after such wounds had ceased to be susceptible to invasion.

Etiolation had a relatively slight influence on infection, but defoliation reduced susceptibility. A relation of temperature to initiation of infection was indicated by the results of inoculations on the north and south sides of the trunks of seedling pear trees; the former showed 15 per cent. successful infections and the latter 28·5 per cent. Girdling cankers exposed to the sun were observed to advance during the winter months several inches more than those on the opposite side.

In the progeny of a hybrid of *P. angustifolia* (highly susceptible) and *P. gibbsii* var. *yunnanensis* (comparatively resistant) resistance appeared to be at least partially dominant. In the F_2 generation no relation was observed between susceptibility and resemblance to parents.

HEINICKE (A. J.). **The influence of sulphur dust on the rate of photosynthesis of an entire Apple tree.**—*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 202–204, 1939.

Continuing his earlier investigations [*R.A.M.*, xvii, p. 696] the author made a heavy application of finely divided sulphur dust on 9th June, 1938, to an 11-year-old Baldwin apple tree enclosed in a specially constructed glass assimilation chamber, a second tree of the same age remaining untreated in a similar chamber.

The results obtained showed that, as compared with the lime-sulphur solution applied in the previous year's experiment [loc. cit.], the sulphur dust had relatively little effect on the rate of photosynthesis of the leaves. During the five days following dusting the two trees showed practically no change in rate of photosynthesis. During the next ten days the average reduction in relative rates due to the treatment did not exceed 11 per cent., while from 24th to 28th June it was only about

6 per cent. The least reduction occurred during the five-day period when the average mean temperature was lowest, the data showing that temperature is a very important factor in determining the amount of injury caused by sulphur. During the eleven days when the temperature was under 90° F. the average rate of photosynthesis was 90·1 per cent. of the control, whereas on the nine days when it was over 90° it was only 79·9 per cent. The greatest reduction for any individual day occurred between 9·30 a.m. and 2.30 p.m. on 23rd June, when the average temperature was 96° and the activity of the dusted tree was 72 per cent. of the normal relationship. A comparison of the respiration rates during the night indicated that the differences then found would account for only a small part of those in the apparent photosynthesis during the day.

Brody (H. W.) & Childers (N. F.). **The effect of dilute liquid lime-sulphur sprays on the photosynthesis of Apple leaves.**—*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 205–209, 8 graphs, 1939.

Experiments carried out in 1938 under greenhouse conditions demonstrated that dilute liquid lime-sulphur sprays applied to leaves of one-year-old Stayman apple trees by means of a hand atomizer at concentrations of 1 in 40 to 1 in 125 may markedly reduce the apparent rate of photosynthesis [see preceding abstract] for three to five days after application, even though no visible burning occurs. When the maximum temperature reaches 90° to 100° F. assimilation is, as a rule, significantly reduced, whatever the spray concentration. The rate of photosynthesis of the sprayed leaves became reduced during the first day after treatment, except in three experiments when it was reduced on the second day.

MacDaniels (L. H.) & Hildebrand (E. M.). **The effect of copper compounds applied to spur units during bloom upon the set of Apple fruits.**—*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 230–233, 1939.

The results are given of experiments made to determine the specific effect on fruit set of copper-lime dust (20-80) and Bordeaux mixture (2-6-100) (the most practical materials for use on blossoming trees against fireblight [*Erwinia amylovora*: *R.A.M.*, xvii, p. 692]) applied to the stigmas of apple blossoms on spur units. In the first series data from six trees showed that the treated flowers set from 34 to 118 per cent. of the fruits of untreated controls. In a second series the set on the treated flowers (one flower on a spur being treated and the control left untreated) varied from 100 to 167 per cent. of that of the corresponding controls, the lighter set of the controls probably being due to competition for food and water between flowers on the same spur. In a third experiment treatment with bactericides at the time of pollination and 24 hours later resulted in no significant difference from the controls in the number of fruits set and the average number of seeds per fruit, but flowers pollinated 36 hours after treatment yielded less fruits and more seeds per fruit. The data presented support the view that these copper compounds may be applied to apple trees in blossom without seriously reducing fruit set.

Woodhead (C. E.). **Pruning in relation to 'mouldy core' of the Delicious Apple.**—*N.Z. J. Sci. Tech.*, xxa, 6, pp. 402–403, 1939.

No correlation could be found between various methods of pruning, drastic and conservative, and the incidence of mouldy core in 20-year-old Delicious apples in experiments at Henderson, Auckland, New Zealand, in 1936–7 [*R.A.M.*, xvi, p. 688].

Harley (C. P.). **Some associated factors in the development of water-core.**—*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 435–439, 1 graph, 1939.

Observations on the prevalence of water-core [*R.A.M.*, xi, p. 55; xv, p. 302] were made on 13-year-old Delicious apple trees in the Wenatchee Valley, Washington, given (*a*) no fertilizer, (*b*) 4·5 lb. of nitrate of soda per tree on 27th May, (*c*) the same on 27th May and 30th July, and (*d*) the same on 30th July only, a 'wet' half of each plot being irrigated frequently, while the other half was kept 'dry', being irrigated only when the trees began to wilt. Throughout the summer branches from trees in all plots were bark ringed and leaf–fruit adjustments made to 10, 30, and 70 leaves per apple. At harvest, all apples from ringed branches and a representative number from the unringed were examined for water-core.

The data obtained showed that secondary factors are operative in the initiation of the condition. Leaf area appeared to be very important in this connexion. No water-core was found in fruits with ten leaves per apple, though exposure to the sun in the case of these fruits was at least as great as that of the apples grown with more leaves. Assuming temperature to be constant, the percentage of water-core was in general directly proportional to the number of leaves per apple.

Next in importance came the influence of nitrogen applied after completion of terminal growth. Double applications gave a higher percentage of water-core than either of the single treatments. Early applications tended to give more water-core than later ones in the case of apples from unringed branches with 30 leaves per apple.

On the whole, more fruits were affected in the dry than the wet plots, particularly with the '70 leaf' and unringed fruits.

These results show that factors closely associated with carbohydrate metabolism in apple leaves predispose the fruit tissues to water-core. Differences in the amount of water-core found in different orchards or trees of a given variety in the same locality may be attributable in part to differences in leaf–fruit ratios, in nitrogen content of the leaves, or both. The factor predisposing to water-core would appear to be primarily the photosynthetic activity of the leaf. Under the experimental conditions (with trees somewhat deficient in nitrogen), it is concluded that the higher percentages of water-core found in the nitrated plots were probably due to increase in the ability of the leaves, through added nitrogen, to synthesize and transport carbohydrates to the fruit.

Ward (K. M.). **Little-leaf—a functional disorder of Apple trees at Stanthorpe.**—*Qd agric. J.*, li, 5, pp. 458–473, 8 figs., 1939.

In experiments on the control of little leaf of apples [*R.A.M.*, xvii,

p. 692], carried out during the 1937–8 growing season at Stanthorpe, Queensland, to find out the best method of supplying zinc to the trees, definite response to zinc treatment was obtained only on trees which had received a dormant spray consisting of 50 lb. zinc sulphate in 100 gals. water, renewed growth following the application of the spray within about three months. None of the other treatments gave positive results, but it is thought possible that some response will appear during the second growing season. Zinc sulphate combined with lime-sulphur (10 lb. zinc sulphate, 5 lb. hydrated lime in 100 gals. water, together with the appropriate strength of lime-sulphur) is said to be a safe spray. The application of a mixture of zinc sulphate and lime either alone or in combination with lead arsenate was not observed to cause fruit russeting or foliar injury on apple trees.

MOORE (M. H.). **Apple scab control. The problem, and some recent research findings as regards its solution.**—*Rep. E. Malling Res. Sta., 1938*, pp. 265–270, 1 chart, 1939.

This is a popular summary of the results of experiments on the control of apple scab (*Venturia inaequalis*) carried out at East Malling during recent years. (The article is reprinted from *The Fruitgrower*, lxxxvii, pp. 569–570, 1939.)

GAUDINEAU (Mlle [M.]), RAUCOURT, & MOREL (G.). **Les tavelures du Pommier et du Poirier.** [Apple and Pear scab.]—*C. R. Acad. Agric. Fr.*, xxv, 20, pp. 687–693, 1939.

In this note, preceded by a foreword (pp. 686–687) by [G.] Fron, the writers describe their detection of the perithecial stages of apple and pear scab (*Venturia inaequalis* and *V. pirina*), the importance of which in the overwintering of the diseases has not hitherto been sufficiently recognized in France. In the case of apple scab, perithecia were observed in an orchard near Bavay (Nord) in January, 1939, and were subsequently found in profusion on material collected in Seine-et-Oise, Oise, Yonne, Ardennes, and Loire et Gironde, and also on foliage in Alsace. According to information from colleagues, perithecia were detected in Puy-de-Dôme in 1938, and the writers also found them on leaves gathered at Versailles in February 1938. At the end of April 1939 perithecia kept in the open showed evident signs of maturity, and on 9th May natural discharge was observed under the microscope. On the 12th, four hours after a heavy shower, ascospores were trapped on vaselined slides placed near infected leaves out of doors. These dates, coinciding with the apple blossom, may be taken as marking the inception of the critical period for infection in the Paris district. The 'pink bud' and 'open blossom' treatments are therefore of special importance in the spraying schedule.

Perithecia of *V. pirina* were observed from 22nd February, 1939, onwards in the Ardennes, at Versailles, in Oise, Seine-et-Oise, Alsace, and at Clermont-Ferrand. Ascospore discharge commenced on 10th May. The pear scab perithecia do not present the same practical interest as those of *V. inaequalis* in the over-wintering of the disease, the conidia of *V. pirina* being already in course of development on 21st

February and evidently playing the chief part in the dissemination of primary infection.

These observations further emphasize the need for stringent orchard sanitation to prevent the formation of cankers harbouring the perithecia during the winter, supplemented by the application of a standard fungicide as soon as the buds begin to swell.

WORMALD (H.). **Bacterial rot of Cherry fruits.**—*Rep. E. Malling Res. Sta., 1938*, pp. 173–175, 2 figs., 1939.

The author states that bacterial spotting of cherry fruits has been observed in England on four occasions. On three of these (in 1931, 1933, and 1938) only single fruits were involved, but an outbreak in 1929 was sufficiently serious for the grower to inquire as to the cause. From the affected fruit *Pseudomonas prunicola* was isolated once, and *P. mors-prunorum* [see next abstract] three times. Infection of plums by *P. mors-prunorum* has been seen on two occasions, but the lesions on cherries were larger (up to $\frac{3}{4}$ of the surface) and more irregular than those on plums and somewhat sunken. Inoculations with either species isolated gave positive results. The fruit is probably infected by bacteria splashed by rain from lesions on the leaves and branches.

WILSON (E. E.) & HEWITT (W. B.). **Host organs attacked by bacterial canker of stone fruits.**—*Hilgardia*, xii, 4, pp. 249–255, 3 figs., 1939.

Organisms isolated at different times and in different parts of California from leaves, blossoms, blossom buds, fruit stems, fruit, and green terminal shoots of cherry, apricot, and plum trees affected with bacterial canker when inoculated into Bing cherry trees produced cankers identical with those caused by *Phytomonas* [*Pseudomonas*] *cerasi* [*R.A.M.*, xvi, p. 328] from limb canker of plum.

Evidence obtained showed that leaf, fruit, fruit stem, and green-shoot infections [the symptoms of which are discussed] did not contribute to the severity of epidemics, infections of these organs usually arising from bacteria originating in bud infections and twig lesions. Blossom and bud infections are often serious and develop concurrently with outbreaks of limb cankers. Such infections are a direct cause of crop loss, reduce the future fruitfulness of branches, and set up foci of infection from which the bacteria invade large limbs.

The symptoms described resemble those of bacteriosis of cherries [*P. prunicola* and *P. mors-prunorum*: ibid., xiii, p. 452; xviii, p. 122] and plums [*P. mors-prunorum*: ibid., xvii, p. 693] in England [see preceding abstract].

WILSON (E. E.). **Factors affecting development of the bacterial canker of stone fruits.**—*Hilgardia*, xii, 4, pp. 259–298, 3 figs., 6 graphs, 1939.

A study made in California of factors affecting the development of bacterial canker of stone fruits due to *Phytomonas* [*Pseudomonas*] *cerasi* [see preceding abstract] after infection has become established showed that canker activity begins in late autumn and ceases in early summer. Increase and decrease in the bacterial population are associated, respectively, with rise and fall in canker activity. Inoculation experiments showed that the period in autumn when cankers could be

obtained, and the period in summer when they could no longer be obtained, corresponded, respectively, with the periods when naturally occurring, established cankers began and ceased activity.

Low temperatures during midwinter resulted in decreased canker extension, while the rising temperature in spring was accompanied by increased extension. The failure to obtain cankers by inoculation in early autumn and early summer did not appear to be due to adverse temperatures, nor did differences in the rates of extension in two successive periods following inoculations seem to be associated with temperature variations. It seems that some factor exerts an influence during spring and becomes more marked as spring passes.

Moderately affected trees in sandy loam were benefited by applications of ammonium sulphate, which appeared to increase the ability of the trees to repair the injury caused by the disease. The evidence obtained indicated that lack of available soil moisture adversely affects the disease, though wide differences in soil moisture, not amounting to actual lack, do not influence the condition.

The severity of the disease in any locality depends on the varieties grown. A few varieties are resistant, more are highly susceptible, and most are intermediate. A distinction is drawn between susceptibility to infection and susceptibility to the inroads of the cankers after infection is established. Thus, the Duarte plum, highly susceptible on a basis of tree mortality, was consistently less favourable to canker progress than President, which suffered less during two years' observations. Duarte is highly susceptible to infection through buds.

Periderm formation and callus development were found to depend upon the growth activity of the tree. Plum varieties beginning growth early, such as Beauty, Kelsey, Santa Rosa, and Duarte, developed periderm around diseased areas and callus at the surface of wounds earlier than those beginning growth late, such as President, Grand Duke, and Tragedy. Cankers in early-blooming plum varieties stop activity earlier in spring than cankers in late blooming varieties. The data obtained indicated a certain relation between periderm development and cessation of canker extension, but did not prove that the periderm prevented canker activity.

Hesse (C. O.). **Variation in resistance to brown rot in Apricot varieties and seedling progenies.**—*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 266–268, 1 fig., 1939.

Observations in the spring of 1935 and in that of 1938, when the weather conditions prevailing in central California were exceptionally favourable to the development of apricot brown rot [*Sclerotinia laxa* and *S. fructicola*: *R.A.M.*, xviii, p. 533], indicated that the varieties Royal, St. Ambroise, Blenheim, Derby Royal, Newcastle, and Oullins Early are very susceptible, Tilton, Wenatchee Moorpark, Hemskirke, and Hersey Moorpark resistant, and Moorpark and Peach most resistant of all those grown locally. This ranking agrees with general observations made in California in other years. Data obtained from seedling apricot progenies suggests that St. Ambroise, Moorpark, and Tilton transmit resistance to brown rot to their progenies in the order named, whereas Royal transmits susceptibility. Hybrids of the susceptible St. Am-

broise were invariably among the most resistant, regardless of the other parent.

ROBERTSON (C. W.) & CATION (D.). **Basicop as a Cherry spray in 1938.**—*Quart. Bull. Mich. agric. Exp. Sta.*, xxi, 4, pp. 291–295, 1 fig., 1939.

In further comparative spraying tests against cherry leaf spot (*Coccomyces hiemalis*) [*R.A.M.*, xvii, p. 694; xviii, p. 261] in Michigan, four applications of liquid lime-sulphur ($2\frac{1}{2}$–100) again failed to give adequate control, while four of Bordeaux mixture (6–8–100) tended to dwarf the fruit and cause injury to the foliage. Cupro-K gave good control, but with severe leaf injury. Basicop used with lime (3–8–100 or 3–6–100) gave satisfactory control with little perceptible injury, but without lime or zinc sulphate-lime it consistently damaged the foliage. In preliminary tests, four applications of basicop-zinc sulphate-lime (2–1–$1\frac{1}{2}$–100) gave adequate control with no injury.

WEAN (R. E.). **Leaf-spot of Black Cherry.**—*Proc. Ind. Acad. Sci., 1938*, xlviii, pp. 48–49, 1 fig., 1939.

In inoculation experiments at Purdue University, Indiana, with the conidial (*Cylindrosporium*) stage of leaf spot (*Coccomyces*) [*hiemalis*] on seedling black cherry (*Prunus serotina*) leaves [see preceding abstract], there were only 18·2 lesions on the upper surface after 15 days' incubation compared with 85·3 on the under, showing that particular care should be taken to secure good coverage of the lower sides with a fine spray. Good (but not complete) control of the disease was given by seven applications of a spray composed of 2 lb. each of copper phosphate and bentonite, 4 lb. hydrated lime, and 50 gals. water, or 2–3–50 Bordeaux mixture.

GERHARDT (F.) & RYALL (A. L.). **The storage of Sweet Cherries as influenced by carbon dioxide and volatile fungicides.**—*Tech. Bull. U.S. Dep. Agric.* 631, 20 pp., 1939.

Data are presented on the storage of sweet cherries in various concentrations of carbon dioxide [*R.A.M.*, xvi, p. 43] and in packing materials impregnated with certain volatile chemicals in a series of experiments conducted at Yakima, Washington, from 1935 to 1937.

The evaluation of gas tolerances at different temperatures for varying periods showed that Bing and Lambert cherries can be held in carbon dioxide without impairment of flavour for 12 days in 40 per cent. at 60° F., 10 in 75 at 45° (Bing only), 20 in 40 at 45°, 17 in 25 at 45° (also the more sensitive Napoleon or Royal Ann), and 31 in 10 at 32°. Fungal decay (*Rhizopus* [*nigricans*], *Monilia*, and *Penicillium*) [loc. cit.] was controlled during 17 to 20 days' storage at 45° in 25 per cent. carbon dioxide. Since a strength of 40 per cent. caused no injury to the fruit at this temperature, the gas can evidently be used with safety over a fairly wide range of concentrations. The addition of 25 per cent. carbon dioxide to the storage air at 45° inhibited decay more effectively than did a 30 per cent. drop in temperature (from 45° to 32°). For firmness, brightness, freshness, and freedom from fungal rots, gas storage at 45° (25 per cent.) is preferable to air storage at 32°. At 40°, 15 per cent.

carbon dioxide sufficed to retard decay to a greater extent than air storage at 32°. Surface pitting was reduced by the storage of the fruit in atmospheres containing 15 and 25 per cent. carbon dioxide.

The fungicidal value of sodium bisulphite in the control of cherry rots was negligible, and the compound further impaired the taste and colour of the fruit. Similar objections apply to methyl bromide, dichloramine-T, and organic iodine compounds. Elemental iodine effectively suppressed fungal growth, but only when used at concentrations liable to produce lenticel burning and superficial discoloration of the fruit.

Roos (K.). **Das Kirschbaumsterben im Baselland. 2. Mitteilung: Die Erscheinungsformen der Krankheit.** [The dying of Cherry trees in the Basle district. Note 2: the symptoms of the disease.]—*Landw. Jb. Schweiz*, liii, 3, pp. 233–258, 30 figs., 1939. [French summary.]

In anatomical studies on the dying-off of cherries reported from the Basle district of Switzerland [*R.A.M.*, xviii, p. 122] it was found that the leaves of affected trees are thicker than those of healthy ones; the mesophyll varies markedly in thickness and frequently cavities are formed between it and the lower epidermis. The vascular bundles of the diseased leaves are smaller than normal and in the cross-sections of the petioles appear entirely disorganized, particularly in the phloem. The width of the annual rings is less, and after the disease has persisted for several years only a few rows of spring wood and none of summer or autumn are added each year, the rings becoming quite indistinct. An abnormal gum production occurs in trees which have been suffering from the disease for many years, the vessels of the branches, stems, and roots being blocked by gum plugs, so that the water-supply is cut off and the branches die primarily from physiological drought. In a partially diseased cherry tree most of the blocked vessels occurred on the diseased side, chiefly in the tap-root and the stem base; the smallest lateral roots were dead, their phloem was quite brown, and the xylem was in process of gum formation and decomposition. Young, newly diseased trees had no blocked vessels, but the medullary rays of the stems and tap-roots showed single cells or rows of cells completely filled with gum. It is concluded from these observations that the abnormal gum production is not the cause of the disease but a secondary symptom.

Clark (J. H.). **Prevalence of certain diseases affecting the foliage in some Strawberry progenies.**—*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 455–460, 1939.

Observations made in 1937 at the New Jersey Experiment Station on 19 strawberry progenies each including 50 or more seedlings showed that the percentages of seedlings entirely free from scorch (*Diplocarpon earliana*) [*R.A.M.*, xviii, p. 402] ranged from 28·8 per cent. in the cross New Jersey 303×New Jersey 327 to 2·1 per cent. in the cross New Jersey 430×New Jersey 141. New Jersey 327 (Teddy Roosevelt× Pearl), to a greater extent than any of the other 14 varieties used as parents, was associated with a comparatively high percentage of healthy seedlings. There was generally a low percentage of unaffected seedlings when Aberdeen, Chesapeake, or 10A (a selection of *Fragaria chiloensis*) appeared in the ancestry, though when varieties with Aberdeen in the

ancestry were crossed with New Jersey 327 there was a comparatively high percentage of healthy seedlings. The only variety in the ancestry of these progenies which was rather consistently associated with scorch resistance was Teddy Roosevelt. The data also indicated that Fairfax, Pearl, and Wyona are intermediate in their ability to transmit resistance, which does not appear to be governed by a single gene, but for which some interaction of factors is probably responsible.

Records from 2,860 seedlings in 1937 failed to indicate that any one of the 19 varieties known to appear in the ancestry of the parents was more closely associated with resistance to mildew (*Sphaerotheca humuli*) [loc. cit.] than any other. The seedlings, however, of five different crosses in which New Jersey 520 appeared as a parent all showed under 5 per cent. infection; in addition, the following, it is thought, may prove of value as parents in breeding for resistance: New Jersey 444 and 445, both second-generation selfed seedlings of Aberdeen; New Jersey 388 and 390, both crosses between Fairfax and 10A; New Jersey 303; and perhaps Catskill. The data indicated that resistance to *S. humuli* is probably due to more than one gene.

Records since 1930 of seedlings showing June yellows [ibid., xviii, p. 191], now generally accepted as being non-infective and genetic in origin, indicated *inter alia* that the yellow character is inheritable, and not due to a single gene.

Castellani (E.). **Su un marciume dell' Eneste.** [On a rot of the Abyssinian Banana.]—*Agricoltura colon.*, xxxiii, 5, pp. 297–300, 2 figs., 1939.

Musa ensete plants growing in the vicinity of Garo and Sidamo (Italian East Africa) were observed by the author to show a disease [the symptoms of which are described] apparently closely resembling 'moko' disease (*Bacterium solanacearum*) [*R.A.M.*, xviii, p. 328], which proved rapidly fatal to young plants under 2 or 3 m. high. Infected material showed the presence of a bacterium which in culture resembled *Bact. solanacearum*, though further tests are required for its identification. The paper concludes with brief suggestions for control.

Parris (G. K.). **A new disease of Papaya in Hawaii.**—*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 263–268, 3 figs., 1939.

A new disease of papaws, causing losses ranging from 6 to over 30 per cent., noted in July, 1937, on the island of Oahu, Hawaii [see above, p. 657], produces marked stunting of the plants, with yellow, crinkled leaves bent downwards and inwards. Little necrosis is present, except at the edges of very young leaves and in the interveinal regions of older ones. As a rule, only the upper two-thirds of affected trees show any symptoms. The affected leaves absciss rapidly, and four to six weeks after the first symptoms have appeared only a few badly distorted, dwarfed leaves are left, clustered together at the top. The leaves developed before any symptoms became apparent persist as a fringe round the base of the plant.

The petioles of the diseased leaves are bent downwards at the point of attachment, and the yellowed leaves bear small, necrotic lesions with yellow margins which range from pin-points to about $\frac{1}{8}$ in. in diameter. The yellow haloes may be small or quite extensive.

Linear, dark green, raised, hydrotic-like streaks, $\frac{1}{8}$ to 1 in. long by $\frac{1}{32}$ to $\frac{3}{8}$ in. wide, may be present on any part of the main stem and on the petioles of the affected leaves. Streaking precedes the development of the yellow discoloration. The fruits are small and 'bleed' profusely.

No organism appeared to be associated with the condition, which is thought to be of virus origin. Juice inoculations from diseased to healthy papaw plants by the carborundum method gave over 75 per cent. successful transmissions, the symptoms appearing within 16 to 21 days.

STEVENS (H. E.). **Avocado sun-blotch in Florida.**—*Phytopathology*, xxix, 6, pp. 537–541, 1 fig., 1939.

The Taylor and Nabal avocado varieties, top-worked on Taft trees grafted on West Indian stocks, have shown definite symptoms of sun blotch [*R.A.M.*, xiv, p. 707] in Florida, where the disease was not hitherto known to occur. The Nabal scions were obtained from apparently healthy trees in California, where sun blotch is prevalent, and so far Taft is the only stock on which the grafts developed symptoms. An infected scion may admittedly transmit sun blotch to the stock on which it is grafted, and the latter, if used later for re-budding or re-grafting, may in turn convey the disease to the new top. In the present instance, however, no sun blotch was observed on the Tafts before top-working, and the origin of the outbreak is difficult to explain, unless infection was carried in the original Taft scions in a latent form.

BERGMAN (H. F.). **Observations on powdery mildew on cultivated Blueberries in Massachusetts in 1938.**—*Phytopathology*, xxix, 6, pp. 545–546, 1939.

Observations in 1938 on the varietal reaction of blueberries [*Vaccinium* spp.] in Massachusetts to powdery mildew (*Microsphaera*) [*alni* var. *vaccinii*: *R.A.M.*, xiii, p. 496] indicate that Pioneer is the most susceptible variety followed by Cabot and Wareham, and Rancocas, Stanley, and especially Harding and Katherine are resistant, while an intermediate position is occupied by Concord, Jersey, and Rubel, the last-named varying greatly in different plantings. In a progeny test in connexion with a scheme for developing resistance by selection, some of the 200 to 300 seedlings of a cross between Wareham and Pioneer were almost free from mildew, others were extensively infected, and between these extremes all gradations were observed. It is thus apparently possible to secure a high degree of resistance even among the offspring of highly to moderately susceptible blueberry varieties.

FRYER (J. C. F.). **Plant protection.**—*ex* Agriculture in the Twentieth Century, pp. 291–307, Oxford, Clarendon Press, 1939.

An outline of the history of plant protection in England is given, and the present organization of the phytopathological service described. Achievements in the control of major pests and diseases since 1913 are also briefly discussed.

SHUTAK (V. G.) & CHRISTOPHER (E. P.). **The influence of Bordeaux spray on the growth and yield of Tomato plants.**—*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 747–749, 1939.

In a test carried out in Rhode Island, Marglobe tomato plants were sprayed between 9 and 10 a.m. standard time at fortnightly intervals from 22nd June, approximately 1 l. of spray being used per plant, with Bordeaux mixture (4–4–50, 4–12–50, and 12–4–50) [*R.A.M.*, xvi, p. 714; xvii, p. 712], of which the last gave a positive test for copper with potassium ferrocyanide.

The results obtained [which are tabulated] showed that the plants sprayed with the 12–4–50, 4–4–50, and 4–12–50 Bordeaux mixture and the unsprayed controls reached, respectively, a final height of 53·7, 52·2, 44·1, and 50·1 in., showed on 30th September 53, 63, 78, and 82 per cent. dead leaves, and gave total yields of 17·7, 16·92, 12·51, and 15·51 tons per acre. The 4–12–50 mixture caused severe desiccation of the young leaves and terminals, while the 12–4–50 mixture gave very effective disease control and produced no visible injury.

The data obtained indicated that Bordeaux mixture retards ripening, but may control disease well enough to increase total yield in some seasons. High-lime Bordeaux mixture should be avoided, but high-copper mixture may be safely used.

HORSFALL (J. G.), HERVEY (G. E. R.), and SUIT (R. F.). **Dwarfing of Cucurbits sprayed with Bordeaux mixture.**—*J. agric. Res.*, lviii, 12, pp. 911–927, 2 figs., 5 graphs, 1939.

In an investigation of the factors responsible for the injury caused by Bordeaux mixture to cucurbits [*R.A.M.*, xv, p. 197], the authors found in experiments with Chicago Pickling cucumbers and Honey Rock muskmelons that, of the three elements composing Bordeaux mixture, copper does not seem to be the primary cause of dwarfing and leaf deformation, unless it is rendered soluble by low hydrogen-ion concentration, whereas lime definitely causes both types of injury and water further aggravates the deleterious effect. An increase in spray load resulted in increased injury. The hydrogen-ion concentration of the spray appeared to be of chief importance: the optimum growth of plants was obtained with a spray mixture approximating P_H7, while more acid or more alkaline sprays reduced growth irrespective of whether copper was present or not. It is suggested that the lime may also possibly cause dwarfing as calcium is known to harden the tissues, thus preventing cell enlargement. It is tentatively concluded from the data obtained in this study that the dwarfing of cucurbits may result from the effect of Bordeaux mixture on transpiration leading to a physiological drought [cf. ibid., xviii, p. 465], from the action of calcium in hardening the young cells, and from reduced photosynthesis owing to the stomata being clogged by the spray.

CUNNINGHAM (G. H.). **Certification of therapeutants.**—*N.Z. J. Sci. Tech.*, XXA, 5, pp. 326–328, 1939.

A list (cancelling the three previously issued) is given of 31 plant protectives tested, approved, and passed for general trading by the Plant

Research Bureau, Department of Scientific and Industrial Research, New Zealand.

VERONA (O.). **Studio sulle cause microbiche che danneggiano la carta e i libri.** [A study on the microbic agents damaging paper and books.]—*Cellulosa*, ii, 2, pp. 94–100; 3, pp. 139–142; 5, pp. 253–256; 6, pp. 308–314, 1938; iii, 1, pp. 38–45; 2, pp. 94–107, 2 col. pl., 31 figs., 2 graphs, 1939. [English summary.]

This is a comprehensive, thoroughly documented study of the micro-organisms concerned in the injury of paper and books in Italy [cf. *R.A.M.*, xviii, p. 362]. The fungi isolated from old books and newly manufactured paper were cultured on malt agar, yeast infusion agar with peptone and glucose, bean agar, carrot slices, and Raulin's liquid, and tested for their carbon and nitrogen requirements and hydrogen-ion relationships by standard methods. They included *Chaetomium elatum*, *C. kunzeanum* [*C. globosum*: *R.A.M.*, xii, p. 779; xv, p. 741; xvi, pp. 147, 773, 838; xvii, p. 791], *Phoma chartae* n.sp., *Cephalosporium* (*Allantospora*) *ciferrii* n.sp., *Trichoderma lignorum*, *Gliocladium roseum* [ibid., xiv, p. 392], *Coniosporium perottianum* n.sp., *Stachybotrys atra* [ibid., ix, p. 455] (with which *S. lobulata* [ibid., xiv, p. 584; xv, p. 741; xvi, p. 147] and *S. alternans* [ibid., xv, p. 673; xviii, p. 362] are considered to be identical), and *S. atra* var. *brevicaule* n.var. Latin diagnoses are given of the new species and variety, together with an emended diagnosis of *S. atra*.

P. chartae is characterized by a hyaline to subolivaceous mycelium, 2·4 to 2·8 μ in diameter; black pycnidia measuring 230 to 360 μ in diameter in culture and 380 to 600 μ on paper, producing hyaline pycnospores, 5·1 to 6·4 by 2·8 to 3·2 μ; and also by hyaline, simple conidiophores, 6·4 to 8·2 by 2·4 to 2·8 μ, and hyaline, elliptical or subovoid conidia, 5·1 to 6·4 by 2·4 to 2·8 μ. Its optimum hydrogen-ion concentration is $P_H 4$; glucose was the best source of carbon and asparagin and potassium nitrate the most easily assimilable forms of nitrogen.

Cephalosporium ciferrii produces a hyaline, branched, septate mycelium, 2·8 to 3·2 μ in diameter, mostly simple, subsessile conidiophores, 15 to 25 μ long, bearing in heads, 12 to 20 μ in diameter, 20 to 40 cylindrical or subreniform, occasionally elliptical, ovoid, hyaline, continuous or rarely uni- or biseptate conidia, 4·8 to 9·6 by 2·5 to 3·2 μ. Peptone served as the best source of nitrogen, while glucose, galactose, and saccharose were the most fully utilized of the carbohydrates. Growth was favoured by a neutral to slightly alkaline reaction.

The aerial mycelium of *Coniosporium perottianum* in culture is effuse, woolly, white, septate, 2·2 to 2·8 μ in diameter, and the submerged fuliginous-brown, septate, branched, 3·2 μ. The few conidiophores produced are hyaline and measure only 6 to 8 μ in length, and the globose or subpiriform, hyaline, later olivaceous and finally blackening, smooth conidia, arising directly from the mycelium or subsessile, are 9·6 to 12·8 μ in diameter. The best sources of nitrogen and carbon are asparagin and saccharose, respectively, and the optimum reaction $P_H 6$.

S. atra var. *brevicaule* differs from the type in its shorter conidiophores, 9·6 to 32 μ, average 19 to 22 μ.

Inoculation experiments on paper with *Chaetomium elatum*, *C.*

globosum, *C. botrichodes*, *S. atra* and its var. *brevicaule*, *Fusarium* sp., *Alternaria* sp., *P. chartae*, and *T. lignorum* resulted in the development of typical staining.

Control measures should be based on a rational treatment of the paper during manufacturing processes, incorporating a reliable disinfectant with the gum, using filtered water for washing and providing well-aerated premises, and the periodical fumigation of libraries with formaldehyde.

Handbuch der Pflanzenkrankheiten. Sechster Band. Pflanzenschutz. Verhütung und Bekämpfung der Pflanzenkrankheiten. [Handbook of plant diseases. Volume VI. Plant protection. Prevention and control of plant diseases.]—Lieferung 3, pp. 577–647, 50 figs., 20 diags., Berlin, P. Parey, 1939. RM. 17·80.

The present instalment of the sixth revised edition of Sorauer's 'Handbook of Plant Diseases', issued under the general supervision of Dr. O. Appel [*R.A.M.*, xviii, p. 43], comprises the conclusion of the section on physical and chemical methods of testing plant protectives by G. Hilgendorff and W. Fischer, and comprehensive, fully documented contributions dealing with the biological control of plant diseases and pests (H. Sachtleben) and technical methods of plant protection, including liquid steeping apparatus (E. Riehm), dusting equipment (A. Winkelmann), and spraying machinery (H. Zillig—incomplete).

Carter (W.). **Injuries to plants caused by insect toxins.**—*Bot. Rev.*, v, 5, pp. 273–326, 1939.

This is a very comprehensive review of the information available to date on the symptoms of phytotoxaemias of insect origin on a large number of plants. A bibliography of 257 titles is appended.

Gratia (A.) & Manil (P.). **Recherches sur les virus des plantes. (Premier mémoire).** [Studies on plant viruses. (First memoir).]—*Arch. ges. Virusforsch.*, i, 1, pp. 21–45, 1 diag., 1939.

This is a tabulated survey, amplified by numerous references to the current literature, of the authors' experiments on plant viruses, extending over a period of five years, at the Liège Bacteriological Institute and Gembloux Agricultural Station, Belgium.

Salaman (R. N.). **Outlines of the history of plant virus research.**—*ex* Agriculture in the Twentieth Century, pp. 261–289, Oxford, Clarendon Press, 1939.

The author reviews the progress of research in plant virus diseases throughout the world and briefly sums up the present knowledge on various aspects of the subject.

Вирусные болезни растений. Сборник 2. Под ред. М. С. Дунина. [Virus diseases of plants. Collection II. Edited by M. S. Dounin.]—240 pp., 58 figs., 11 graphs, 9 diags., Moscow, Изд. Всесоюзн. Инст. Защ. Рас. [Publ. pan-Soviet Inst. Pl. Prot.], 1938. [Received July, 1939.]

Among the 14 papers and nine summaries included in this book the following may be noted.

L. Kara-Mourza. Physiological changes in virus-affected cotton (pp. 56–72). In a study on cotton leaf curl in Azerbaidjan [*R.A.M.*, xvii, p. 392] the dry weight of the infected plant averaged only 59 per cent. of that of the healthy plant, the number of bolls was reduced to 58·8 per cent., and the dry weight of the roots to 36·6 per cent. Diseased leaves are thicker than healthy ones (418 μ and 233 μ, respectively), and often form a second palisade layer on the upper side but sometimes also on the lower side; leaf cells are very enlarged, and those of the veins and petioles contain large numbers of starch granules which are absent from healthy leaves. Transpiration is generally lower in diseased plants than in healthy ones, except in the evening, when it is often higher. The nitrogen content of the sap is higher than in healthy leaves.

R. P. Nikolaeff & Mme S. M. Kondratieva. A comparative biochemical description of healthy potatoes and potatoes affected with virus diseases (pp. 73–82). The results of this study show that the percentage water content of tubers affected by rugose mosaic, crinkle, aucuba mosaic, or leaf roll is from 3 to 10 per cent. higher than that of healthy tubers or tubers from streaked plants. The amylase and peroxydase activity was generally higher in healthy than in diseased tubers: for instance, in the variety Wohltmann 7805 the peroxidase activity expressed in seconds was 2·4 in healthy tubers, 1·0 in mottle, 2·1 in leaf roll, and 1·1 in crinkle tubers. The catalase activity was generally lower in diseased than in healthy tubers.

N. A. Ryachovsky. Leaf curling of tomatoes in the districts of Kursk and Voronezh (pp. 83–100). Of the 42 tomato-growing farms in the Kursk and Voronezh districts of the U.S.S.R. only two were found free from leaf curling [ibid., x, p. 493; cf. xv, p. 556] during 1933–4, half of the others being severely affected by the disease. A three-year study on the harmfulness of this disease, the origin of which as yet remains unknown, showed that it reduces the length of the stem by 17·9 per cent., its thickness by 9 per cent., the number of pinnae by 10·4 per cent., and the size of the leaf surface by 51 per cent., but has no effect on the number of leaves. The average loss in yield for three years was 30, 45, and 70 per cent. for mildly, moderately, and severely affected plants, respectively. The weight of individual fruits was reduced by from 5·9 to 22·9 per cent. on diseased plants during the wet year 1933, but no such reduction occurred during the following dry year. Infection was found to be carried by the seed, the presence of even the slightest infection in one year causing 100 per cent. infection in the following season. It is considered premature at this stage of the investigations to draw conclusions as to the nature of the disease.

Mme E. A. Asnitzkaya. Streak of tomatoes (pp. 101–109). Tomato streak [ibid., xvi, p. 210] is stated to be a new disease for the U.S.S.R. In 1935 the percentage of infection recorded in various parts of the Union varied from 20 to 100 per cent. in the glasshouses and up to 10 per cent. in the field. The virus nature of the disease was proved in inoculations with sap filtered through a Chamberland candle. A serological analysis (by the drop method) of plants affected with streak showed the presence of the tobacco mosaic virus and potato virus Y [? X]. Successful inoculations with suspensions of ground seeds from diseased plants indicate that the virus may be seed-borne. In two pot experiments it is

stated that 80 and 50 per cent., respectively, of the plants grown in soil moistened with the expressed juice of infected plants developed the disease. Pruned tomatoes showed 4·7 per cent. infection as compared with 1·3 per cent. in the unpruned controls. The disease was more prevalent in cold frames (particularly for late sown tomatoes) and in glasshouses in winter than in hot-beds, and in glasshouses with overhead watering than in those with underground irrigation. The percentage of infected plants was considerably reduced by the addition of nitrogen and potassium to the soil before transplanting. Under glasshouse conditions Sparks' Earliana and Boudennovka were the most susceptible among the ten varieties tested.

M. N. Medish. The spread of 'stolbur' of tomatoes in connexion with ecological conditions. Preliminary information (pp. 110–116). A disease of tomatoes observed in 1935 in the Krasnodar district is thought to be identical with 'stolbur' as described by Russian authors and with big bud reported from Australia [ibid., xviii, p. 631]. Field observations showed that the infection never exceeded 1 per cent. on low and moist sites, while it amounted to 20 per cent. in dry situations, and that the considerable amount of precipitation during September usually arrested the further development of the disease. It appears therefore that the development of 'stolbur' is related to the water economy of the plant.

I. K. Koratchevsky & Mme A. V. Semenkova. On the susceptibility of Solanaceae and Convolvulaceae to 'stolbur' (pp. 118–124). In work carried out during 1935–6 in the Crimea, 'stolbur' was artificially transmitted to tomato from eggplant, *Physalis peruviana*, chilli, and *Solanum nigrum*. Suspected hosts, showing anatomical and morphological characteristics similar to those of plants infected by 'stolbur', are *Convolvulus arvensis*, sweet potato, potato, and *Taraxacum megalorrhizon* var. *gumnanthum*.

J. Tzivenko. Virus diseases of *Physalis angulata* L. (pp. 125–132). Observations carried out at Kharkoff on Mexican tomato (*P. angulata*), which is stated to be a valuable crop for the northern districts of the U.S.S.R., being more hardy than ordinary tomatoes, revealed the presence of four types of virus disease. The first to appear was mosaic, which reduced the height of the plant from 70 to 80 cm. to 40 to 50 cm. 'Giantism' increased the height of the plant from 70 to 80 to 90 to 110 cm., the thickness of the stem (at the base) from 2 to 2·5 to 2·5 to 3 cm., the size of the leaf from 7·5 by 2 to 11·5 by 7 cm., and the number of flower buds. 'Stringiness', a severe form of tomato fern leaf [ibid., xvii, p. 78], drastically reduced the size of the leaves and lowered the height of the plant. Reductions in the yield caused by these diseases were from 104 fruits in the healthy plant to 50, 14, and 6, respectively. Leaf roll was observed only on a few plants. Plants affected with either of the virus diseases described had longer pistils and shorter stamens than healthy plants.

N. I. Feiginson. Virus diseases of fruit trees (pp. 139–180). Following brief descriptions of known virus diseases of fruit trees, the author states that so far mosaic has been tentatively identified in the U.S.S.R. on apples, pears, cherries, plums, peaches, and apricots.

Mme O. B. Nataljina. Virus diseases of cultivated berries (pp. 181–196). In the Moscow, Leningrad, and Gorky districts raspberries have

been found affected with diseases believed to be identical with curl [ibid., xvi, p. 194], dwarf [ibid., xviii, p. 377], leaf roll [loc. cit.], and yellows [loc. cit.]. In 1936 curl affected 5·1 per cent. of raspberries in the Moscow district, Usanka being the most susceptible variety, and yellows occurred on 55·6 per cent. of raspberries in the Moscow and 49·3 per cent. in the Gorky districts, being less serious in that of Leningrad. Moderate and severe yellows were found to reduce the yield by 42 and 38 per cent., respectively. Black currants were attacked by streak chlorosis, though the disease was not very widely spread and was less injurious than reversion [loc. cit.], which often occurred simultaneously. In 1936 reversion affected 40 per cent. of currants in the Gorky, 26·5 per cent. in the Moscow, and 0·2 per cent. in the Leningrad districts.

LIHNELL (D.). **Untersuchungen über die Mykorrhizen und die Wurzelpilze von Juniperus communis.** [Studies on the mycorrhiza and root fungi of *Juniperus communis*.]—*Symb. bot. upsaliens.*, iii, 3, 141 pp., 3 pl., 18 figs., 1939.

The juniper (*Juniperus communis*) roots from about 50 localities of Sweden examined by the author from 1932 to 1938 at the Upsala Botanical Institute were uniformly covered with a mycelial network, dense in some samples and sparse in others, consisting largely of the brown, regularly septate hyphae of *Mycelium radicis atrovirens* [*R.A.M.*, xviii, p. 608].

Many of the organisms isolated in pure culture on 2·5 per cent. malt extract (agar or solution) and tested for mycorrhizal synthesis assumed an entirely passive attitude towards the juniper roots, which they failed to penetrate; among these were *Mortierella alpina*, *Mucor* spp., including *M. ramannianus*, and *Mycelium radicis juniperi* IV, VI, VII, and X. From these observations it may be inferred that the fungi in question also lead a purely epiphytic existence on the roots in nature. The remaining fungi under investigation acted in a more or less parasitic manner, though a number of them, e.g., *M. r. juniperi* III, V, VIII, and IX, were unable to traverse the hypodermal layers to which their hyphae were confined and their activity soon ceased. Vigorous parasites like *Rhizoctonia juniperi*, however, cannot be restrained by the hypodermal 'armour' from deeper penetration. For example, *R. juniperi* (characterized by a matted, white, later reddish mycelium, consisting of septate, profusely branched hyphae, 3 μ in diameter, frequently with a spiral upward rolling at the apex and sometimes forming cords) and *M. r. atrovirens* formed chlamydospore chains which eventually developed into sclerotia in the hypodermal region, whereas in the subhypodermal layers the fungi existed exclusively as thin-walled hyphae. The black hyphal coating formed by *M. r. juniperi* III (dark brown, hyaline-tipped, septate hyphae, 2·5 to 3·5 μ in diameter) round the roots was somewhat reminiscent of the 'mantles' of ectotrophic mycorrhiza, from which it differed, however, in its extreme irregularity. Roots inoculated with *M. r. juniperi* VIII reacted by the envelopment of the hyphal tips in dotted tubular sheaths with lignified walls, similar to those observed in cases of spontaneous infection and usually serving to prevent the further progress of the fungus. *M. r. atrovirens*, notwith-

standing its prevalence as a symbiont of juniper roots, appears to be only a weak parasite on healthy material.

Ectotrophic mycorrhiza of the *M. r. nigrostrigosum* type [ibid., xv, p. 308] were found on roots from only two of the 50 localities represented in the investigations, forming a 'mantle', 30 to 35 μ in thickness, composed of very thick-walled, brownish-black hyphae, 3·5 to 5 μ in diameter. In an as yet unpublished study the writer has demonstrated the probable identity of this organism with *Coenococcum graniforme*, described from Denmark by Ferdinandsen and Winge (*K. VetHøjsk. Aarsskr.*, 1925); not only are the mycelia in pure culture identical but anastomosis takes place freely between them. Inoculation experiments with *C. graniforme* on juniper did not, it is true, lead to the formation of the typical reticulate 'mantle' associated with *M. r. nigrostrigosum*, but the characteristic structures were produced on Scots pine (*Pinus sylvestris*) and birch (*Betula verrucosa*); thick 'mantles' were formed on willow (*Salix repens*), while on spruce (*Picea abies*) the transitional forms between complete mycorrhiza and simple, undifferentiated hyphal overgrowths resembled those developing on juniper. Apparently the natural tendency of *C. graniforme* (*M. r. nigrostrigosum*) to form mycorrhiza is easily checked, in the case of its less congenial hosts, by the relatively unfavourable conditions prevailing in artificial culture.

The endotrophic mycorrhiza of junipers conforms to the standard vesicular-arbuscular or Phycomycetoid type [ibid., xviii, p. 468], for which the author prefers Burgeff's (1938) term 'thamniscophagous'. Most of the primary roots of the trees in all the localities investigated were already at this early stage converted into endophytic mycorrhiza, the anatomical characters of which displayed a remarkable uniformity irrespective of their place of origin or of the constitution of the soil. The penetration of the fungus into the roots is effected, mostly in June and early July, through the transfusion cells of the hypodermis, assisted no doubt by the chemotropic stimulus of assimilable host secretions. The invading hypha generally forms a few simple loops in the transfusion cells and first subhypodermal layer, branching only commencing in the next layer, whence it extends both longitudinally and laterally until finally the whole primary cortex as far as the endodermis is involved, though the central cylinder is never attained and the meristematic tissues remain free from infection until the root tip becomes metacutinized at the end of the growing period. The average diameter of the normally non-septate hyphae, containing a variable number of nuclei, 1·5 to 2 μ in diameter, is 4 to 6 μ, but a thickness of 10 μ may be reached. The walls contain chitin and in all probability cellulose.

The spherical to oval vesicles begin to develop in the second and third cortical layers and measure on an average 60 by 30 μ, with walls up to 3 μ in thickness. The function of these organs is not quite clear, but in the writer's opinion they most likely act as receptacles for the accumulation of reserve foodstuffs for the winter months, the sporangial interpretation being regarded as untenable. On the other hand, the arbuscules, developing through the gradual attenuation of the hyphal branches from relatively coarse to extremely slender (0·5 to 0·8 μ) dimensions, would appear to undergo an eventual transformation into sporangioles,

5 to 10 or 15 μ in diameter. Gallaud's (*Rev. gén. Bot.*, xvii, 1905) view that the arbuscules are of the nature of haustoria is considered to be the most plausible. In this connexion the physiological relationships between the endophyte and its host are critically discussed at some length, and a survey is given of early and recent literature on this and cognate aspects of the mycorrhizal question.

JAMESON (DOROTHY H.) & SCHMIDT (CATHERINE M.). **Boron as a plant nutrient. [A bibliography of literature published and reviewed, July, 1938, to December, 1938, inclusive.] (With index.) Supplement I.**—40+vi pp., American Potash Institute, Inc., Washington, D.C., 1939. [Mimeographed.]

This supplement to the annotated bibliography of the literature of boron as a plant nutrient published by the American Potash Institute [*R.A.M.*, xviii, p. 199] contains 172 items.

MILAD (Y.). **Physiological studies in lime-induced chlorosis.**—*Bull. Minist. Agric. Egypt* 211, 56 pp., 7 pl., 3 graphs, 1939.

Studies [which are described in detail] carried out by the author in California in 1925 to 1927 into lime-induced chlorosis of pear trees growing in calcareous soils containing 15 to 40 per cent. calcium carbonate showed that, as a rule, the leaves and stems contained less iron per unit dry weight than similar leaves and stems of normal pear trees on non-calcareous soils. The affected leaves contained a higher percentage of calcium and manganese than green ones from calcareous or non-calcareous soils, but twigs and two- to three-year-old stems did not show this difference. Chlorotic and green leaves of about the same age and taken from the same orchard varied considerably in percentage of iron present, based on dry weight; in many cases chlorotic leaves contained higher percentages of iron than some of the green foliage.

Analyses of tracheal sap showed that in every instance the sap from trees on calcareous soils had a higher P_H value than that from trees on non-calcareous soils. The chlorotic stems had the highest value (P_H7 to 7·2), normal green stems from non-calcareous soils the lowest value (P_H6 to 6·2), and green stems from the calcareous soils were intermediate. The alkalinity of the tracheal sap in the chlorotic trees did not appear to cause any precipitation of iron in the wood of the tree or in the veins of the leaves, but sometimes induced a high iron content in chlorotic leaves by decreasing the solubility of the incoming iron in the leaf cells.

The susceptibility of pears, apples, white lupins, and rice to chlorosis on calcareous soils was ascertained to be associated with slow production of carbon dioxide by the roots. The importance of carbon dioxide in increasing the solubility of iron in soils rich in lime was demonstrated by quantitative analysis. Chlorosis in white lupins [cf. *R.A.M.*, xviii, p. 530] growing in a suspension of calcareous soils was prevented experimentally by applications of carbon dioxide gas. It is suggested that the part played by carbon dioxide in increasing the availability of iron compounds in calcareous soils is due to its reducing the P_H value of the soil solution round the root hairs and rootlets, and to its action as a solvent for ferrous carbonate, which in the calcareous soil might be

formed from the reduction of ferric oxides in the presence of organic matter and excessive moisture.

PEYRONEL (B.). **Sulla durata della vitalità negli Zigomiceti.** [On the duration of vitality in the Zygomycetes.]—Reprinted from *Atti Accad. Torino*, lxxiv, 11 pp., 1939.

During more than ten years' study of the Zygomycetes the author had occasion from time to time to make transfers on to fresh medium of cultures of various ages of 87 species, varieties, races, and strains, in the course of which he found that when the transfers were made with due care all the fungi were living after 15 to 20 months in culture, while those possessing chlamydospores, giant cells, and zygospores were still alive after four to six years.

The maximum duration of vitality was shown by the genus *Absidia*, in which, out of 19 species, *A. capillata*, *A. coerulea*, and *A. glauca* [*R.A.M.*, xviii, p. 137] were still alive after 71 months in culture, while *A. hyalospora* and *A. lichtheimii* [ibid., xv, p. 314] were still alive after 64 and 59 months, respectively. Next in this respect came *Syncephalastrum*, in which the three species observed, viz. *S. cinereum* [ibid., xii, p. 149], a species from British Guiana, and a species from Florence, were still alive after 56, 57, and 56 months, respectively. In *Mucor*, out of 19 species observed only three were still alive after 50 months (*M. racemosus* and *M. circinelloides* [ibid., xviii, p. 137], each 57 months, *M. ambiguus*, 50).

The author attributes extreme longevity in culture to the presence of numerous chlamydospores, giant cells, or zygospores, which are rich in reserve materials and able to resist adverse environmental factors for long periods. This is illustrated by the case of *Rhizopus nigricans* and *R. arrhizus*, the former of which (showing very few zygospores) was found to retain its vitality in culture for only 18 months, while the latter (which produced abundant chlamydospores) was still alive after 58.

In the case of *A. glauca* and *A. coerulea*, both heterothallic [loc. cit.], the longest vitality was noted in culture containing mycelium of both sexes (71 months), while the cultures containing only plus mycelium were dead after 59. This would suggest that the most persistent organs are the zygospores, or that the chlamydospores, always present in the bisexual mycelium, do not develop in plus mycelium.

WYCKOFF (R. W. G.). **The ultracentrifugal analysis of the latent mosaic virus protein.**—*J. biol. Chem.*, cxxviii, 3, pp. 729–733, 1 diag., 1939.

The sedimentation diagram of a typical preparation of the latent mosaic of potato [potato virus X] obtained at the Rockefeller Institute for Medical Research, Princeton, New York, by subjecting the clarified juice of infected Turkish Tobacco plants to four successive ultracentrifugations at 30,000 r.p.m. presented the following features. The principal boundary is sharp, moving at a rate corresponding to the constant $S_{20}=113\times10^{-13}$ cm. sec.$^{-1}$ dynes^{-1}. A faint, sharp, second boundary with S_{20}=about 130×10^{-13} can also be perceived; the component responsible for this is sometimes absent, irrespective of whether the

sample has been purified by ultracentrifugation or salting-out. A single precipitation in the cold with either 30 per cent. ammonium sulphate or potassium citrate, followed by two ultracentrifugal sedimentations, gave a sharp-boundaried product, while a protein with a fairly sharp boundary was furnished by precipitation with hydrochloric acid at P_H4. Alcohol precipitation at P_H5 altered the protein so completely that no measurable sedimenting boundary was given. The virus protein molecule was found to be stable within the general limits defining its toxicity (P_H 5·7 to 10·1), on the alkaline side of which an immediate and complete breakdown occurs, while in acid solutions proximity to the isoelectric point introduces a complex situation producing abrupt alternations in the boundaries between sharpness and diffuseness.

Pill (R.). **Uwagi dotyczace wykresu pojawów raka Ziemniaczanego w Woj. Śląskim od roku 1924 do 1937.** [Notes on the incidence of the Potato wart disease in the province of Silesia from the year 1924 to 1937.]—*Roczn. Ochr. Rośl.*, vi, 2, pp. 28–30, 1 graph, 1939. [German summary on pp. 39–40.]

The campaign against wart disease of potato [*Synchytrium endobioticum*: *R.A.M.*, xvi, p. 832] has been in progress in the Polish province of Silesia for the last ten years. In 1924 the disease covered 15 hect., in 1929 the maximum infection was reached when 343 hect. (in 1,529 farms) were infested, but by 1937 the area infected had fallen to 8·9 hect. (in 157 farms), owing to the planting of resistant varieties.

Bermuda Byelaws made by the Bermuda Board of Agriculture on 7th March, 1939, under the provisions of The Boards Act, 1929. Control of plant diseases and pests.—4 pp., 1939.

By changes in legislation made by the Bermuda Board of Agriculture on 7th March, 1939 [cf. *R.A.M.*, xvi, p. 143], cut flowers and fresh vegetables from the United States, formerly imported into Bermuda without restriction, are now subject to inspection on arrival between 1st June and 30th September. The importation of citrus fruits from the West Indies is no longer forbidden.

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xiii, 5, p. 113, 1939.

New Zealand. The Orchard and Garden Diseases Act Extension Order of 18th January, 1939, proclaims the yellow dwarf disease of onions (*Allium* virus 1) [*R.A.M.*, xvii, p. 576] to be a disease within the meaning of the Orchard and Garden Diseases Act, 1928.

Amtliche Pflanzenschutzbestimmungen. [Official plant protection regulations.]—*Beil. NachrBl. dtsch. PflSchDienst*, xi, 2, pp. 63–64, 1939.

Denmark. Under a decree of the Ministry of Agriculture dated 21st February, 1939, plants and parts thereof imported into Denmark from other countries must be accompanied by a properly authenticated certificate vouching for their origin in an area free from potato wart (*Synchytrium endobioticum*) and at least 5 km. distant from any place in which the disease has been observed during the past ten years [*R.A.M.*, xiv, p. 544].

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Müller (K. O.). **Über die Abbauresistenz der Kartoffel und die Züchtung abbaufester Kartoffelsorten.** [On the resistance of the Potato to degeneration and the breeding of degeneration-resistant Potato varieties.]—*Z. Zücht. A.*, xxiii, 1, pp. 1–19, 6 figs., 4 graphs, 1939.

A detailed, tabulated survey is given of the writer's experimental studies, which have now been in progress for a number of years at the Biological Institute, Dahlem, Berlin, on breeding potatoes for resistance to degeneration, bringing the results up to 1938. The outcome of the investigations may be summarized as follows. The varieties Erdgold and 9089 (a Dahlem selection of South American origin cultivated locally for ten years in succession) are heterozygotic in their reaction to leaf roll and streak (Y) [*R.A.M.*, xviii, p. 409], hence the extreme variability in this respect of the progeny of crosses between the two. The selfed family of 9089 showed much less conspicuous symptoms of leaf roll than that of Erdgold, while the hybrid offspring occupied an intermediate position. On the other hand, the differences between the two selfed families in regard to the development of streak were relatively insignificant. The time of appearance of the initial leaf roll symptoms varied appreciably (from the first to the third year of cultivation) among the members of 'full-sister' series. There was no diminution in the severity of streak occurring for the first time in the second or third years as compared with the first, and the same presumably applies to leaf roll. Since resistance to degeneration is transmitted not only through the egg cell, but also by way of the pollen, and as reciprocal combinations of susceptible and resistant forms showed no differences beyond the limits of experimental error, variations in individual reaction cannot be attributed to plasmotypic modifications but are probably genotypically conditioned. The reactions to leaf roll and streak are independently inherited.

The value of different commercial varieties for breeding purposes was shown by hybridization tests to be very divergent. For instance, in the Erdgold × 9089 cross, not one of the seedling descendants was superior to the latter parent in its resistance to streak or leaf roll, whereas the combination of 9089 and Ackersegen gave rise to individuals far surpassing both parents in resistance to degeneration, especially as regards the Y virus. Evidently the accentuation of resistance is a result of a blend of genes occurring separately in the two parents. Experiments in the cultivation of 9089 hybrids at localities outside Dahlem showed that the primary genotypical reaction of a variety to leaf roll or streak may

be more or less modified by environmental conditions: 9089 itself, in fact, may 'roll' conspicuously in unduly dry soils, though at Dahlem it has consistently proved highly tolerant of the leaf roll virus. These observations lend support to Merkenschläger's 'ecological' theory of degeneration [ibid., xvi, p. 400].

The incidence of infection and virulence of symptoms varied independently of each other, so that there are obviously no genetic correlations between the degrees of resistance, expressed by fewness of diseased plants, and tolerance, manifested by mildness of symptoms. The climax of the 'degeneration minimum' and the rapidity with which it is reached are determined by the two factors, resistance and tolerance: the greater the tolerance, the smaller is the difference between the normal yield and the 'degeneration minimum', and the higher the resistance, the more slowly is the 'degeneration minimum' approached. Like the degrees of tolerance and resistance, the extent of the 'degeneration minimum' and the rapidity with which it is reached are genotypically conditioned, though important modifications in the natural trend may arise through the varying incidence of insect vectors of the viruses and the amount of infestation in neighbouring stands.

The breeding material under observation has demonstrated the possibility of combining resistance to degeneration with the following characters: medium-early to latest maturity, resistance to wart disease [*Synchytrium endobioticum*], productivity, correct tuber shape, short stolons, and resistance to *Phytophthora* [*infestans*] (biotype group A) [ibid., xvii, p. 483].

Details are given of the field performance of two 9089 hybrids, viz. (Erdgold × 9089) 100 and (Deodara × 9089) 10. The former is tolerant of leaf roll, resistant to Y, and surpasses the best commercial varieties in long-continued productivity in heavily infested areas. The latter is similar to the foregoing in its reaction to leaf roll but immune from, or very highly resistant to, Y, of which not a single case was observed in five years' cultivation at Dahlem, nor did any of the 24 tobacco plants inoculated with the expressed juice give positive reactions. There are also indications (requiring further confirmation) that 9089 is both tolerant of, and resistant to, mosaic (X virus).

Some practical recommendations for breeding are made on the basis of these results. Forms must be developed, by inbreeding or rational hybridization, possessed of far-reaching homozygosity in respect of resistance to viruses. Genes conferring this quality will be found among certain widely cultivated commercial varieties, local sorts, and numerous old selections which have long disappeared from the market but are available in the 'relic collection' used for demonstration purposes by the Reich Food Board. While the development of forms with a high degree of resistance to, or even immunity from, mosaic and Y is a possibility, tolerance of leaf roll is apparently the best that can be anticipated [ibid., xvi, p. 487 *et passim*] at the present stage of knowledge of the disease. The Reich Food Board now undertakes degeneration trials on the same lines as those for wart disease, and growers would be well advised to take advantage of this arrangement, whereby they can immediately be relieved of all susceptible seedlings and retain only such material as promises to be of real value in the work of selection.

LESZCZENKO (P.). & KURYLUK (W.). **Badanie odpozności Ziemniaków na raka ziemniaczanego Synchytrium endobioticum Perc. Sprawozdanie VI.** [Testing resistance of Potatoes to the wart disease *Synchytrium endobioticum* Perc. Report VI.]—*Prace Wydz. Chor. Szkodn. Rośl. państw. Inst. nauk. Gosp. wiejsk., Bydgoszcz*, 18, pp. 77–86, 1939. [French summary.]

As a result of further testing of potato varieties for resistance to wart disease (*Synchytrium endobioticum*) [*R.A.M.*, xvi, p. 832] the Polish varieties Herulia, No. 190 Stiegler, and Śląskie Różki are stated to be resistant as well as the foreign varieties Carnea, Novifolia, Sieglinde, Edelgard, Edelragis, Frühbote, Stärkeragis, Viola, Tannenzapfen, Weltwunder, and Krebsfeste Kaiserkrone.

PIEKARSKI (A.). **Dobór odmian rakoodpornych na Śląsku.** [The selection of wart-resistant Potato varieties in Silesia.]—*Roczn. Ochr. Rośl.*, vi, 2, pp. 19–27, 1939. [German summary on p. 38].

The standard potato varieties grown in the Polish provinces of Upper and Lower Silesia are all resistant to wart disease [*Synchytrium endobioticum*]. Ackersegen, the most popular Voran, and Mittelfrühe have yellow-fleshed tubers with a good flavour, and give the highest yields in tubers and starch per hect.; worthy of mention are the early varieties Bürckner's Früheste, Kaiserkrone, Paulsen's Juli, and Lichtblick, the medium-early Rosafolia and Böhm's Mittelfrühe, the medium-late Erdgold, Jubel, and Hindenburg, the late Ovalgelbe and Hetman, and the industrial variety Parnassia.

RAYSKY (D. M.). Действие мороза на конидии **Phytophthora infestans D.B.** [The effect of frost on the conidia of *Phytophthora infestans* de Bary].—*Sovetsk. Bot., 1939*, 2, pp. 93–96, 1939.

In experiments carried out during the winter of 1935–6 at the Voronezh Potato Experiment Station, cultures of *Phytophthora infestans* [*R.A.M.*, xviii, p. 271] on slices of potato and conidial suspensions of the fungus were frozen out of doors and the conidia then germinated in the laboratory at a temperature of 8° to 9° C. in the morning and 13° to 14° at midday. Exposure to low temperatures seemed to increase the proportion of conidia germinating in a vegetative manner. The conidia withstood temperatures of – 26·5° for seven days (46 out of 100 germinated) and – 13·2° for ten days (35 out of 100 germinated). Most of the zoospores liberated from the conidia were killed after ten minutes at – 11·3° and all after half-an-hour.

YABUTA (T.). & HAYASHI (T.). **Biochemical studies on 'bakanae' fungus of the Rice. Part II. Isolation of 'gibberellin', the active principle which makes the Rice seedlings grow slenderly.**—*J. agric. chem. Soc. Japan*, xv, 3, pp. 257–266, 8 figs., 1939. [Japanese, with English summary on pp. 41–42.]

By means of an elaborate chemical technique [which is described in detail] the writer, at the Imperial Agricultural Station, Tokyo, isolated in a crystalline state the stimulatory substance of the 'bakanae' (elongation) fungus of rice (*Gibberella fujikuroi*) [*R.A.M.*, xviii, p. 54].

The final product, for which the name 'gibberellin' is proposed, is an almost colourless, amorphous powder, producing the characteristic effects of the disease on inoculation into rice seedlings even in such minute amounts as a 0·00002 per cent. solution. It soon loses its potency in an aqueous alkaline solution, but is fairly stable in an acid one. T. Yabuta and Y. Sumiki have recently resolved the crude amorphous gibberellin into two distinct crystalline substances, both active for rice plants, by fractional crystallization from ligroin mixed with ethyl acetate or ethanol: one (A) occurs as long prisms, m.p. 194° to 196° C., and the other (B) as short prisms, m.p. 245° to 246°.

Inoue (Y.). **Comparison of the cellulose-decomposition by culture strains of the Rice blast fungus, Piricularia oryzae Br. et Cav.**—*Ann. phytopath. Soc. Japan*, ix, 1, pp. 33–40, 1939. [Japanese, with English summary.]

Of the 21 strains of *Piricularia oryzae*, the agent of rice blast [*R.A.M.*, xviii, p. 580] in Japan, compared on a cellulose-containing synthetic agar medium for their cellulose-decomposing properties, nine were very active in this respect, three definitely weak, and the remainder intermediate. Generally speaking, a strong capacity for cellulose disintegration was correlated with a high degree of pathogenicity to rice.

Herzog (Gerda). **Über den Einfluss der Dämpfung auf die biologischen und chemischen Eigenschaften der Gartenerden.** [On the influence of steaming on the biological and chemical properties of garden soils.]—*Bodenk. u. PflErnähr.*, N.F., xii, 5–6, pp. 339–384, 9 graphs, 1939.

In connexion with an exhaustive study on the influence of steam sterilization, mostly carried out with the Pillnitz apparatus described by Noll [*R.A.M.*, xvi, p. 124], on twelve horticultural soils in the Leipzig and Pillnitz districts of Saxony, the writer refers to the reaction of [unspecified] soil fungi to this treatment. In acid soils (P_H 4·7), used for heath (*Erica*) and azalea [*Rhododendron*] cultivation, the steaming was followed by a sharp increase of fungal activity, the number of fungi rising from 10,000 and 100,000, respectively, per gm. of soil to 1,000,000 and 5,000,000, respectively, by the 42nd day. In alkaline soils, on the other hand, the number of fungi counted 42 days after sterilization was only a fraction of the original population, especially in the autumn and winter months [ibid., xii, p. 721; cf. also xiv, p. 121]; in the summer the figures were somewhat higher, but at no time was the intensive multiplication characteristic of acid soils observed in those used for the growing of cyclamen (P_H 7·8) and chrysanthemum (7·6).

Burges (A.). **Soil fungi and root infection. A review.**—*Brotéria*, viii (xxxv), 2, pp. 64–81, 1 graph, 1939.

In this critical review of the present knowledge of soil fungi the author discusses the occurrence of fungi as spores and mycelium in the soil, the number of fungi present, and the biologic groups of fungi represented.

Keyworth (W. G.). **Verticillium wilt of Hops. A summary of observations during 1938.**—*Rep. E. Malling Res. Sta., 1938*, pp. 244–249, 1 pl., 2 figs., 1939.

During the period 1924 to 1937, *Verticillium* wilt disease of hops was reported from an increasing number of farms in England, and by the end of the 1938 season it had been observed on 28 farms in Kent and Sussex, and one in Herefordshire. The varieties showing the disease are Fuggle, Tolhurst, and Tutsham, as well as other Golding varieties and two Wye seedlings. The only constant symptom is the light brown colour of the wood in a severely affected bine, the discoloration extending from the base at least 18 in. up.

While the cause of hop wilt was ascertained by Harris to be *V. albo-atrum* [*R.A.M.*, xv, p. 741], hops in three gardens were found in 1938 showing the same symptoms though infected by *V. dahliae*.

On some farms a fluctuating type of infection occurs, the disease varying in intensity from year to year, while on others the disease is progressive, the hills dying within a year or two after developing the symptoms. The evidence indicates that the disease is probably spread through an infected garden by the cultural practices adopted. Thus, in a square-plant garden cultivated in both directions, in which the disease first appeared as a patch of 20 hills in 1934, the diseased hills were evenly distributed all over the garden by 1938; in a Worcester-plant garden cultivated in one direction only, in which the disease broke out in one patch in 1936, spread took place almost entirely in one direction from the patch. As infected bines contain mycelium throughout their whole length and as the soil round a diseased hill is infected, it appears to be probable that infection is spread by workers carrying diseased material about; the disease may also be spread from one garden to another in this way. Dissemination is also effected by the use of infected bine as manure.

Control measures recommended include the burning of bine from infected gardens, not planting hops adjacent to or after potatoes or raspberries, and the avoidance of setts from diseased gardens. [This paper is reprinted in *J.S.-E. agric. Coll. Wye*, xliv, pp. 23–29, 1 pl., 2 figs., 1939.]

Ocfemia (G. O.) & Celino (M. S.). **The behaviour of POJ 2878 Sugar Cane in relation to Fiji disease and transmission of the virus by nymphs of Perkinsiella vastatrix.**—*Phytopathology*, xxix, 6, pp. 512–517, 1 fig., 1939.

Among apparently healthy stalks of P.O.J. 2878 sugar-cane selected from a field at the Los Baños College of Agriculture, Philippine Islands, two produced shoots of which some were infected by Fiji disease [*R.A.M.*, xviii, p. 626] and others apparently healthy. The latter did not originally contain the virus of the disease, but readily became contaminated by it in transmission experiments with *Perkinsiella vastatrix*, of which not only adults but also nymphs of the second to the fifth instars can convey infection. On the other hand, nymphs hatching from eggs laid by viruliferous leafhoppers do not carry the virus. Viruliferous adults require a minimum incubation period of 24 hours before acting as vectors of Fiji disease.

Hughes (C. G.). **Alternate hosts of B. vasculorum, the causal agent of gumming disease of Sugar Cane.**—*Tech. Commun. Bur. Sug. Exp. Stas Qd, 1939*, 3, pp. 35–63, 1 col. pl., 11 figs., 1939.

This is an expanded account of the writer's studies in Queensland on the host range of *Bacterium vasculorum,* the agent of gumming disease of sugar-cane, a note on which has already appeared [*R.A.M.*, xviii, p. 624].

Padwick (G. W.). **The genus Fusarium. I. Known occurrence in India.** —*Indian J. agric. Sci.*, ix, 2, pp. 171–184, 1939.

With the object of opening the way for a study of the Indian species of *Fusarium,* the author presents a fully documented list of the species of this genus known to cause diseases in India. He then critically examines and discusses the reasons on which various workers have based their determination of species, and concludes that for the present it is desirable to accept the classification of Wollenweber and his associates. As few new species as possible should be created, and the use of new biological characters, such as host reaction, to delimit species should be avoided.

Mains (E. B.). **Rusts from British Honduras.**—*Contr. Univ. Mich. Herb.* 1, pp. 5–19, 1939.

An annotated list is given of 58 species of rusts [including ten new ones] belonging to 11 genera found in British Honduras.

Hirschhorn (Elisa). **Las especies del genero 'Ustilago' en la Argentina.** [The species of the genus *Ustilago* in the Argentine.]—*Darwiniana, B. Aires*, iii, 2, pp. 347–418, 6 pl., 6 figs., 1939.

A critically annotated list is given of 44 species (one new) of *Ustilago* found in Argentina. The author restores or refers several species of *Sphacelotheca*, including *S. hydropiperis*, to *Ustilago.*

Tavares (I.). **Catalogo dos fungos de Pernambuco.** [A catalogue of the fungi of Pernambuco.]—*Bol. Agric., Pernambuco*, iv, 1, pp. 1–33, 58 figs., 1939.

This is an annotated list of 58 lignicolous Polyporaceae of the Pernambuco district of Brazil, mostly collected by B. Pickel and determined by C. Torrend.

Ulbrich (E.). **Neue Arten von Nanga Parbat leg. C. Troll. Fungi. Nachtrag zu Pucciniaceae.** [New species from Nanga Parbat collected by C. Troll. Fungi. Addendum to Pucciniaceae.]—*Notizbl. bot. Gart. Berl.*, xiv, 124, pp. 343–344, 1939.

Since his erection of the genus *Trolliomyces* to contain the rust formerly known as *Puccinia rosae*, but differing from other representatives of *Puccinia* in its bi- or tricellular teleutospores and in the production of pycnidia [*R.A.M.*, xviii, p. 59], the writer's attention has been drawn to the prior establishment by H. Sydow (*Ann. mycol., Berl.*, xix, p. 167, 1921) of the monotypical genus *Teloconia* for the same fungus. *Trolliomyces* therefore becomes a synonym of *Teloconia* and the

rose rust should in future be known as *T. rosae* (Barcl.) Syd. (syn. *P. rosae*, *P. kamschatkae* [ibid., xiii, p. 185], *Phragmidium rosae* [loc. cit.], and *Trolliomyces rosae*). The unicellular, broadly ovate to subspherical spores, 36 to 40 μ in diameter, found sparsely scattered among the teleutosori of the Himalayan collections of the rust are believed to be the hitherto unobserved uredospores.

BUCHWALD (N. F.). **Fungi Imperfecti (Deuteromycetes). En Veiledning i studiet af de sekundære Sporeformer hos Svampene.** [Fungi Imperfecti (Deuteromycetes). A guide to the study of the secondary spore forms in fungi.]—ii+144 pp., 1 pl., Copenhagen, K. Vet. Landbohøjsk., 1939.

This book has been written mainly for the use of the students at the Royal Veterinary and Agricultural College, Copenhagen.

Many fungi play their most important role while still in their imperfect condition, but the little systematic attention paid to fungi in this state has been quite out of proportion to its great practical significance. The author seeks to provide students with a systematic basis for their studies with the microscope. The introduction presents an objective account of every attempt that has been made to classify fungi in their imperfect state. Keys are provided for the accepted families and subfamilies and for the selected genera, and the recent literature is cited under each heading. The species listed are especially the Scandinavian phytopathogens, but all genera of significance to applied mycology are introduced, whether they appear as human and animal pathogens, or occur in pharmacies, fermentation work, or on textiles or foodstuffs.

The bibliography at the end cites all the key systematic books, manuals of plant pathology, and periodicals of mycology and phytopathology; there is also a full authors' index, and an index of generic names. The book provides an admirable guide for the student who desires to become well informed about the literature on Fungi Imperfecti as they are known up to the year 1939.

DA CÂMARA (M. de S.) & DA LUZ (C. G.). **Some fungi from the Atlantic islands and the Portuguese colonies.**—*Bol. Soc. broteriana*, Sér. II, xiii, pp. 95–99, 4 figs., 1938. [Received August, 1939.]

The following and two other fungi are recorded in this list: a fungus on coffee from St. Thomas island, West Africa, doubtfully referred to *Hemileia coffeicola* [*R.A.M.*, xiv, p. 303], *Tilletia horrida* on rice in Portuguese India, *Diplodina* [*Didymella*] *lycopersici* on tomato in Funchal, Madeira, and *Gloeosporium* [*Colletotrichum*] *lagenarium* on vegetable marrow in the Azores.

DA CÂMARA (E [M.] de S.) & DA LUZ (C. G.). **Mycetes aliquot Lusitaniae II.** [Some fungi of Portugal II.]—*Agron. lusit.*, ii, 1, pp. 41–63, 1939.

This second instalment of the writers' annotated list of Portuguese fungi [cf. *R.A.M.*, xvi, p. 563] comprises 75 species, nine of which are new to science. Parsley leaves were found to be attacked by *Cercospora petroselini* and those of begonia by *Oidium begoniae* [ibid., xv, p. 443], both new records for the country.

Charles (Vera K.). **Noteworthy Florida and Georgia fungi.**—*Plant Dis. Reptr*, xxiii, 8, pp. 130–133, 1939. [Mimeographed.]

An *Oidium* causing a conspicuous powdery mildew on leaves of papaw in Florida corresponds morphologically to *O. caricae* [*R.A.M.*, x, p. 554] but develops on the upper surface of the leaves instead of the under. This fungus should not be confused with *Ovulariopsis papayae* [ibid., xii, p. 680], which has considerably larger, subclavate conidia, singly borne.

Christoff (A.) & Christova (Eleonora) Нѣколко нови растителни болести за България (IV приносъ). [Some plant diseases new to Bulgaria (4th contribution).]—*Bull. Soc. bot. Bulgarie*, viii, pp. 39–49, 1939. [English summary.]

In this further contribution [cf. *R.A.M.*, xv, p. 745] the authors record for the first time from Bulgaria 21 parasitic fungi, of which the following may be mentioned; *Puccinia antirrhini* on *Antirrhinum majus* [ibid., xviii, p. 457], *Didymella lycopersici* on eggplant [ibid., xi, p. 809], *Penicillium crustosum* on chestnut [cf. ibid., xviii, p. 355], *P. expansum* on quince, pear, and apple [ibid., xviii, p. 441], *Botrytis tulipae* on tulip [ibid., xviii, p. 655], *Alternaria radicina* [ibid., xviii, p. 573] on carrot, and *Sclerotium* [*Sclerotinia*] *gladioli* on gladiolus [ibid., xvii, p. 506].

Radoslavoff (A.). VII. приносъ къмъ паразитната гжбна флора на България. [Seventh contribution to the flora of parasitic fungi of Bulgaria.]—*Bull. Soc. bot. Bulgarie*, viii, pp. 50–54, 1939. [German summary.]

This list of 32 parasitic fungi (chiefly rusts) found in Bulgaria [cf. *R.A.M.*, xv, p. 745] includes eight new records for the country.

Imazeki (R.). **Studies on Ganoderma of Nippon.**—*Bull. Tokyo Sci. Mus.* 1, pp. 29–52, 15 figs., 1939. [Japanese, with English summary.]

In this monographic study on ten Japanese species of *Ganoderma* (including two new to science) the author excludes the section *Amauroderma* from the genus, which he divides into three subgenera, viz., *Euganoderma*, *Elfvingia*, and *Trachyderma* based on the characters of the sporophores and their crusts.

Gadd (C. H.). **Disease in non-productive bushes.**—*Tea Quart.*, xii, 2, pp. 75–83, 2 pl., 1939.

In this paper (read before the sixth conference of the Tea Research Institute of Ceylon, February, 1939) the author discusses in popular terms 'phloem necrosis' of tea in Ceylon [*R.A.M.*, xvii, p. 705], and states that the condition has now been transmitted by grafting. The slow development of the disease he considers to be one of its most dangerous features. In one experiment in a small, heavily infected area, 266 out of 639 bushes examined (42 per cent.) were found to be affected, while eight months later when the same bushes were re-examined 334, or 52 per cent. were affected. At the first examination many of the affected bushes would have appeared healthy to planters,

and at the second they looked no worse, individually. In the author's opinion, all unproductive tea bushes should be removed, as these will include the worse cases of phloem necrosis, and the condition may prove capable of causing very great damage.

GADD (C. H.). **Report of the Mycologist for 1938.**—*Bull. Tea Res. Inst. Ceylon* 19, pp. 27–33, 1939.

In this report [cf. *R.A.M.*, xvii, p. 705] it is stated that dadap (*Erythrina lithosperma*) stumps seldom give rise to root disease of tea [ibid., xvi, pp. 128, 634] in Ceylon, but in 1938 such stumps were found to have formed centres of infection for *Ustulina* [*zonata*]. When cutting out dadaps the lateral roots should be severed and as much of the stumps as possible should be removed. *Rosellinia arcuata* [ibid., xviii, p. 579], also responsible for tea root disease, was found infecting *Indigofera dosua* growing among tea, though not showing the characteristic mycelial 'stars'.

Experimental evidence indicated that tea 'phloem necrosis' [see preceding abstract] is not due to boron deficiency. If it should prove to be due to a virus it would have to be regarded as the most serious tea disease recorded. Examination of 267 necrotic bushes showed necrotic areas in the leaf petioles, stems, and roots in 65, 48, and 77 per cent. of the bushes, respectively, while such areas were found in all three parts of the same bush in 25 per cent. of the cases. Curled leaves were present on 46 per cent. of the bushes. Symptom variability may indicate that more than one disease is concerned, but in the present state of knowledge it seems preferable to regard phloem necrosis as one disease, the symptoms of which differ slightly with different tea varieties. Occasionally the disease can be recognized from the back of the leaves, where the small veins are brown and prominent. Affected bushes in the early stages of attack were noted at St. Coombs in 1938, suggesting that the disease is increasing.

The leaf fall of *Grevillea* [*robusta*] trees due to *Phyllosticta* [ibid., xvii, p. 705] has been found in several new localities. Death of the branches may result from repeated defoliations.

KEILLER (P. A.). **Note on the analysis of leaves from Tea bushes affected by 'witches' broom'.**—*Tea Quart.*, xii, 2, pp. 96–97, 1939.

Spectroscopic analysis by Dr. Judd Lewis of tea leaves from bushes affected by witches' broom [*R.A.M.*, xvi, p. 1; xvii, p. 138] on two estates in Ceylon showed in the case of one a high chromium content and in the other the presence of chromium in quantities about $\frac{1}{10}$th as great, with an abnormal amount of barium in leaves from the worst affected bush. These results are taken to indicate that witches' broom is more likely to be due to poisoning than deficiency, and that it may not always be due to the same cause. The application of potassium chromate or chrome alum was found to result in the slow death of tea bushes.

ROBINSON (J. R.). **Shape of Tobacco mosaic virus particles in solution.**—*Nature, Lond.*, cxliii, 3631, pp. 923–926, 1939.

This is a criticism of some recent contributions to the knowledge of the shape of tobacco mosaic virus particles [*R.A.M.*, xviii, p. 630] in

solution on the grounds that the capillary viscometers commonly used for this purpose are quite unsuited, by reason of their high rate of shear, for the study of anomalous systems. A cylinder apparatus, permitting simultaneous control and determination of the state of orientation in relation to the double refraction of flow and isocline angle, should be employed, and Kuhn's equation (*Z. phys. Chem.*, A, clxi, p. 427, 1932) [cf. *R.A.M.*, ibid., xvii, p. 707], which is inapplicable to particles smaller than 10^{-6} cm., replaced by a more complex formula taking account of the progressive increase of orientation as the rate of shear is raised.

FRAMPTON (V. L.). **Viscosimetric studies on the Tobacco mosaic virus protein. I.**—*J. biol. Chem.*, cxxix, 1, pp. 233–244, 1 diag., 7 graphs, 1939.

An adaptation of the Ostwald viscometer (*Kolloid Zschr.*, xxxviii, p. 261, 1926) used in the writer's studies on the tobacco mosaic virus protein at Cornell University, New York, is described. Sols containing 0·62 mg. of the virus protein per c.c. in a phthalate buffer were found to show a marked anomalous viscosity increasing with a decrease in the solution from P_H 6·37 to 5·15. At P_H 4·15 the aggregates became so large that flocculation began after the sol had been in the viscometer about ten minutes, corresponding to a point at about 300 dynes per c.c. This anomaly was greatly reduced by the addition to the protein solutions of urea [*R.A.M.*, xviii, p. 630] or glycine, which did not immediately affect the biological activity of the virus, as indicated by tests on *Phaseolus vulgaris*. The application of the Kuhn equation to the tobacco mosaic virus protein is considered to be demonstrably invalid [see preceding and next abstracts], inasmuch as the formula in question is based essentially on laminar streaming in conformity with the ideal laws of Stokes, Fick, and Poiseuille, which are, however, not obeyed in the present case. Evidence is briefly presented for the thixotropic character of the system made up of the virus protein in water.

FRAMPTON (V. L.). **On the molecular weight of the Tobacco-mosaic protein.**—*Phytopathology*, xxix, 6, pp. 495–497, 1939.

The author critically examines the basis on which the estimate of 17,000,000 (later corrected to 43,000,000) for the molecular weight of the tobacco mosaic virus protein is calculated. This basis was that Stokes's law is valid for the virus proteins, but recent information indicates that Fick's and Pouiselle's laws are inapplicable to sols of the protein in question and consequently that Stokes's law also is not followed [see preceding abstracts]. He concludes that the molecular weight of the protein is not definitely known.

PFANKUCH (E.) & KAUSCHE (G. A.). **Phosphatatische Inaktivierung von pflanzlichen Viren.** [Phosphatatic inactivation of plant viruses.]—*Biochem. Z.*, ccci, 3, pp. 223–224, 1939.

Virus preparations of tobacco mosaic and potato virus X, inoculated into *Datura stramonium* after 48 hours' treatment with phosphatase extracts from potato and beet, were found to be largely inactivated (average of 18 single lesions per half leaf as compared with 41 after treatment of the same duration with water).

KAUSCHE (G. A.), PFANKUCH (E.), & RUSKA (H.). **Die Sichtbarmachung von pflanzlichem Virus im Übermikroskop.** [Rendering the plant virus visible in the ultramicroscope.]—*Naturwissenschaften*, xxvii, 18, pp. 292–299, 12 figs., 1 graph, 1939.

By a process involving the desiccation of the virus sol it is possible to secure homogeneous dried gelatinous preparations of the tobacco mosaic and potato X viruses [*R.A.M.*, xviii, p. 543] showing their structural organization. The use of reasonably high tobacco mosaic virus concentrations (10^{-5} gm. protein per c.c.) precludes the lateral aggregation of the sols into bands and facilitates the separate drying of each rod or thread. The dimensions of the smallest structures, computed by this method, were found to agree with the estimates obtained by X-ray and ultracentrifugation calculations. The bacillary and filiform elements falling within the ranges of 300 and 150 mμ, respectively, in length and 15 mμ in diameter are considered to represent the actual molecules of the tobacco mosaic virus, any multiples thereof being regarded as linear or lateral aggregations.

RYJKOFF (V. L.) & SMIRNOVA (Mme V. A.). **Accumulation of virus of Tobacco mosaic in plants when nitrogen is withheld from them.**—*C. R. Acad. Sci. U.R.S.S.*, N.S., xxiii, 1, pp. 95–97, 1939.

The results of pot experiments in which nitrogen was withheld from tomato plants inoculated with tobacco mosaic showed that the titre of the virus in the juice of such plants is not lower than in those receiving a normal supply of nitrogen, and that the virus continues to accumulate at the expense of the 'sound' proteins of the plant [cf. *R.A.M.*, xiv, p. 474]. Diseased plants suffered much more from cutting off the nitrogen than healthy plants.

JOHNSON (J.). **Studies on the nature of brown root rot of Tobacco and other plants.**—*J. agric. Res.*, lviii, 11, pp. 843–863, 2 pl., 5 figs., 1939.

In studies in Wisconsin on the behaviour of the agent of brown root rot of tobacco [*R.A.M.*, vi, p. 3; xviii, p. 634] it was found that approximately three days' exposure of tobacco and tomato plants to brown root rot soil was necessary before the first symptoms became even faintly visible. When diseased soil was mixed with sterilized soil, it required 5 to 20 per cent. of infected soil to produce traces of the disease. At higher concentrations the amount of disease was roughly proportional to the percentage of brown root rot soil present. It was not possible to extract the agent of the disease from soil by leaching with water. The addition of fresh, diseased roots to a soil produced the diseased condition in the soil, but when filtered juice from such roots was added no disease developed. The disease agent was found to be intolerant of rapid air-drying of the soil but withstood prolonged slow drying. It was destroyed by the comparatively low temperature of 45° C. in 24 hours and by moderate freezing temperatures maintained for relatively long periods. Aeration and light had no effect on the pathogenic factor, which was eliminated from the soil by several germicides as well as by powdered charcoal, whereas other chemicals with similar properties were

ineffective. In tests of 100 plants grown in brown root rot soil the following were susceptible: tomato, cotton, cowpea, soy-bean, bean (*Phaseolus vulgaris*), vetch, potato, eggplant, chilli, lettuce, lucerne, and pigeon pea; a number of species were classed as resistant or immune. The use of certain susceptible crops, e.g., tobacco, in diseased soil rather strikingly diminishes the disease in subsequent years, due in great part to the exposure of cultivated soils to the influence of the weather.

Histological studies showed that one of the chief characteristics of brown root rot lesions is the sharp demarcation by the cell walls of the diseased areas from surrounding healthy tissue. Thickening of the cell walls occurs in the affected parts, and the nuclei disintegrate in the diseased cells. The lesions are often superficial but usually spread through the cortex of young roots, after which rapid and extensive spread may occur round the stele. The living cortex sloughs off from the diseased roots, leaving only the thread-like central cylinder. No organism was found constantly associated with the disease, though this evidence does not disprove the possibility that organisms on the exterior of the roots or in the soil may excrete toxins necrotically injurious to the roots. So far, however, the true nature of the causal agent is not known.

SPENCER (E. L.) & LAVIN (G. L.). **Frenching of Tobacco.**—*Phytopathology*, xxix, 6, pp. 502–503, 1939.

In spectrographic analyses at the Rockefeller Institute for Medical Research frenched tobacco plants [*R.A.M.*, xvii, p. 632] grown in field soil under greenhouse conditions gave negative reactions to the thallium test as did also those in sand cultures except where the mineral (as thallium nitrate) was added to the nutrient at a minimum concentration of 0·1 p.p.m. (sufficient to produce faint symptoms of frenching). It might thus be inferred that frenching and thallium toxicity are two distinct disorders, but in view of the similarity of the conditions, not only as regards symptoms but also in respect of control, it is more likely that the toxic action of the chemical alters the metabolism of the root, thereby giving indirect rise to some disturbance involving the top. Thallium may also occur in the soil in the form of a complex compound less readily translocated to the aerial portions of the plant than the pure salts used in the experiments. If this hypothesis be accepted, the spectrographic detection of thallium only in those plants treated with thallium nitrate would not necessarily eliminate the mineral as a possible cause of frenching.

MIDDLETON (J. T.). **Infection of Tomato and Red Clover with conidia of Pleospora lycopersici and Macrosporium sarcinaeforme.**—*Phytopathology*, xxix, 6, pp. 541–545, 2 figs., 1939.

In inoculation experiments at the Division of Plant Pathology, University of California, aqueous suspensions of the conidia of *Pleospora lycopersici* were found to be capable of infecting Dwarf Champion, San José Canner, Earliana, and Stone tomato [*R.A.M.*, xiv, p. 799] leaves and flowers, but gave negative results on red, white, and white sweet clovers (*Trifolium pratense*, *T. repens*, and *Melilotus alba*) and lucerne; these legumes were susceptible, on the other hand, to *Macrosporium*

[*Stemphylium*] *sarcinaeforme* [ibid., xviii, p. 141], which is non-pathogenic to tomato. Cultural dissimilarities and pathogenic differences between *S. sarcinaeforme* and *P. lycopersici* are considered to preclude the application of the former binomial to the imperfect stage of the latter [ibid., i, p. 63].

TAKIMOTO (S.). **Bacterial plant diseases in Japan. VII. Studies on the bacterial spot of Tomato.**—*Ann. phytopath. Soc. Japan*, ix, 1, pp. 22–32, 3 figs., 1939. [Japanese, with English summary.]

The causal organism of a destructive tomato disease, involving the leaves, pedicels, peduncles, stems, and fruits (with seeds) and causing heavy losses in Chosen, Japan, was found to be practically identical with *Bacterium vesicatorium* [*R.A.M.*, xviii, p. 421]. Infection takes place through the stomata and injured tissues, rarely by way of unwounded fruits. The bacterium overwinters in the soil and on diseased plant refuse. Good control may be obtained by seed treatment with 1 in 1,000 to 1 in 3,000 mercuric chloride, followed by two to three applications of 3–2–75 or 3–2–90 Bordeaux mixture prior to the appearance of the first symptoms.

TRUE (R. P.) & SLOWATA (S.). **Scouting and sampling Elms with symptoms commonly associated with the Dutch Elm disease as an aid in eradicating Ceratostomella ulmi.**—*Phytopathology*, xxix, 6, pp. 529–537, 1 graph, 1939.

Fortnightly inspections of 2,239 elm trees in 1936 and of 4,424 in 1937 in New Jersey indicated that, with the advance of summer, the prevalence of the symptoms associated with *Ceratostomella ulmi* [*R.A.M.*, xviii, p. 641] increased markedly until the onset of defoliation in the middle of September. The efficiency of symptom sampling reached a maximum during the latter part of June and throughout July. Internal discoloration was associated with the external symptoms in $\frac{1}{3}$ to $\frac{1}{2}$ of the trees sampled, i.e., 3 to 10 per cent. of the total trees observed. Relatively low percentages of the specimens collected from trees showing both internal and external symptoms yielded *C. ulmi* on culturing. In one carefully inspected and sampled plot series in an area where the disease was prevalent, twelve trees, showing no symptoms before 1st September in either year, revealed infection on close examination on the felling of the 419 remaining trees.

FERDINANDSEN (C.) & JØRGENSEN (C. A.). **Skovtræernes sygdomme. Anden Halvdel.** [Forest tree diseases. Second half.]—pp. vii–xi, 287–570, 95 figs., Copenhagen, Gyldendalske Boghandel, 1939. Complete Kr. 25·50 (bound Kr. 31·50).

This second part of the authors' comprehensive treatise on forest tree diseases in Denmark [*R.A.M.*, xviii, p. 212] completes the systematic account of the Thelephoraceae (14 pp.), Hymenomycetes including Polyporaceae [ibid., xviii, p. 215], and Agaricaceae, and then deals with blue-staining organisms, diseases in tree nurseries, mycorrhiza, alder nodules (*Actinomyces alni*) [ibid., xviii, p. 335], and bacterial diseases. The work is furnished with keys for the determination of the various organisms on their several hosts, a 21-page bibliography, and an index of Danish and Latin names.

HERRICK (J. A.). **Growth and variability of Stereum gausapatum in culture.**—*Phytopathology*, xxix, 6, pp. 504–511, 3 figs., 1939.

In an intensive two-year study at the Kent State University, Ohio, of the development on potato dextrose agar at 25° C. of twelve selected isolates out of a total of 58 of *Stereum gausapatum* from the rotted heart wood of oaks in various parts of the north-eastern United States [*R.A.M.*, xvi, p. 505], wide variations were consistently observed in the growth rate and mycelial characters of the different cultures. In one isolate a depressed zone developed round the site of inoculation. Other cultures remained cottony and nearly white instead of assuming a dark coloration and becoming consolidated into tough mats. Again, the mycelia of certain strains were conspicuous by their rich orange colour and concentric zonation, and one showed also a dense, abrupt margin of the advancing mycelium. Only one strain progressed in the accepted normal manner as a submerged mycelium.

JENKINS (ANNA E.). **New species of Taphrina on Red Maple and on Silver Maple.**—*J. Wash. Acad. Sci.*, xx, 5, pp. 222–230, 4 figs., 1939.

English and Latin diagnoses are given of two new species of *Taphrina*, namely, *T. dearnessii* on red maple (*Acer rubrum*) and *T. carveri* on silver maple (*A. saccharinum*) [cf. *R.A.M.*, xviii, p. 355], both originally collected by J. Dearness in Ontario in 1890 and subsequently found by G. W. Carver and other mycologists in different parts of the United States. The circular or angular spots produced by *T. dearnessii*, often of a bistre- to blackish-brown colour with cinnamon centres on dry specimens, sometimes causing rugosity of young foliage, may be situated on any part of the red maple leaf, though they are commonly marginal or distributed along the main veins; the affected samarae are partially or entirely discoloured and covered with cylindrical to slightly clavate asci (which may also be hypo-, rarely epiphyllous), rounded or truncate at the apex, 17 to 29 by 8 to 13 μ (frequently 21 to 29 by 10 to 11 μ), the stalk cell rounded, flattened, or slightly pointed at the base, occasionally moderately lobed, 6 to 12 by 10 to 18 μ, containing eight globose to elliptical spores, 2·8 to 5·6 by 3 to 3·5 μ.

The rugose, circular, elliptical, or irregular spots, up to 3 by 1 cm. in diameter, of *T. carveri*, of which 25 or more may occur on a single leaf of *A. saccharinum*, range in colour in herbarium specimens from sepia on the upper surface through isabella and light brownish-olive on the lower to blackish-brown on both sides; the amphigenous or more commonly hypophyllous, cylindrical asci, with rounded or truncate apex, measure 23 to 35 by 7·8 to 16·8 μ (often 26 to 30 by 9 to 15 μ), with a rounded, flattened, or irregular stalk cell, sometimes slightly pointed at the base, occasionally moderately lobed, 4 to 15 by 10 to 22 μ, containing eight subglobose or elliptical ascospores, 4 to 7 μ in diameter, and budded conidia, spherical or oblong-elliptical, the latter up to 7 by 3 μ.

HEMMI (T.) & IKEYA (J.). **Studies on Lenzites gibbosa (Pers.) Hemmi n. comb. causing wood-rot of deciduous trees.**—*Ann. phytopath. Soc. Japan*, ix, 1, pp. 1–15, 2 pl., 1939. [Japanese, with English summary.]

A detailed account is given of taxonomic and morphological studies

on *Trametes gibbosa*, a widespread agent of white, spongy decay among broad-leaved trees [*R.A.M.*, ix, p. 499] throughout Japan. The shape of the tube orifices is strikingly variable, not only on different sporophores but on various parts of the same one, the lamellate form showing more extensive development than the trametoid. The fungus is therefore transferred to the genus *Lenzites* as *L. gibbosa*. The optimum temperature for mycelial growth on apricot and potato decoction and soy agars was just above 28° C.

KAWAI (I.). **On the intracellular bodies associated with the dwarf disease of Mulberry trees.**—*Ann. phytopath. Soc. Japan*, ix, 1, pp. 16–21, 4 figs., 1939. [Japanese, with English summary.]

Oval, round, or occasionally irregular, multivacuolate intracellular bodies, 4·5 to 13·5 by 4·5 to 6 μ, have been found closely associated with the nuclei of the epidermal or mesophyll cells of the leaves of mulberry trees affected by dwarf disease in Japan [*R.A.M.*, xi, p. 756]. The detection of these elements is considered to place the virus origin of the disorder [cf. ibid., xvii, p. 538] beyond a doubt.

FRON [G.] & NÈGRE (A.). **Sur une maladie du Micocoulier.** [On a disease of the Nettle Tree.]—*C.R. Acad. Agric. Fr.*, xxv, 20, pp. 691–693, 1939.

Attention is drawn to a disease of the nettle tree (*Celtis australis*) in the Nîmes district of France, where it is very popular for planting in avenues and the like and largely used to replace elms destroyed by *Graphium* [*Ceratostomella*] *ulmi*. The disorder is characterized by stunting, malformation, brown spotting, and premature shedding of the leaves. The primary cause of the trouble is still obscure, the development on the affected foliage of *Exoascus* [*Taphrina*] *celtidis* being insufficiently active to account for the symptoms, while the attacks of a Microlepidopterous insect, *Lithocollethis millierana*, also appear to be secondary.

HEPTING (G. H.) & TOOLE (E. R.). **The Hemlock rust caused by Melampsora farlowii.**—*Phytopathology*, xxix, 6, pp. 463–473, 2 figs., 1939.

Up to 82 per cent. of the 1938 shoots of eastern hemlock (*Tsuga canadensis*) were destroyed in nurseries in western North Carolina by *Melampsora farlowii*, which also, as reported in 1935 [*R.A.M.*, xv, p. 331], attacks the Carolina hemlock (*T. caroliniana*) to a much slighter extent. The rust, which also infects the leaves and cones, is widespread in the eastern United States and Canada, appreciable damage being caused, however, only under conditions promoting dense foliar growth, e.g., in nurseries, hedges, and the like. The disease is not restricted to small trees or the lower parts of large ones, profuse twig and cone infection having been observed in 1938 in the tops of two trees, 80 and 45 ft. in height.

Spring inoculum is supplied by the teleutosori on the over-wintered twigs and cones killed during the previous spring. In western North Carolina sporidial production, which must apparently be preceded by at least ten hours' rain, usually extends from early May to mid-June, coinciding with the most active period of shoot development. Twig infection apparently occurs through the needles.

The best control of *M. farlowii* in nursery experiments was given by weekly applications throughout May of lime-sulphur (4 lb. dry in 50 gals.) plus casein spreader (2 lb. in 50 gals.), only 3 per cent. of the twigs on the treated trees being killed as against 19 per cent. on the unsprayed. The average cost of the treatment was 0·4 cents per tree per application.

KARAKOULIN (B. P.). К вопросу о методах испытания антисептиков, употребляемых при борьбе с домовыми грибами. [On the methods of testing antiseptics used in the control of house fungi.]—*Sovetsk. Bot., 1939*, 2, pp. 57–65, 1939.

The author tested anthracene oil and carbolineum in the control of *Merulius lacrymans* and *Coniophora cerebella* [*C. puteana*: *R.A.M.*, xviii, p. 644] by a method previously outlined by other workers [ibid., xiii, p. 70], in which the value of the antiseptic was estimated by the growth intensity of the test fungus on wood sections saturated with it and placed in Erlenmeyer flasks containing cultures of the fungus on garden soil and wood. The oils used were diluted with benzol. The growth of both fungi was completely arrested by doses of anthracene oil of between 1 and 2 per cent. (of the weight of the wood) while the 5 per cent. carbolineum (the largest concentration used) only retarded it slightly.

OLSSON (P. A.). **Svalöfs Majrova. En Rovsort, speciellt för odlingsområden där klumprotsjukan härjar.** [Svalöf's May Turnip. A Turnip variety specially adapted for cultivation areas where club root is destructive.]—*Sverig. Utsädesfören. Tidskr.*, xlviii, 6, pp. 471–476, 1fig., 1939.

Details are given of the trials carried out at Svalöf, Sweden, from 1936 to 1938 with several turnip varieties, among which the round, white-fleshed May (especially strain J013) proved outstanding in resistance to club root (*Plasmodiophora brassicae*) [*R.A.M.*, xii, p. 670]. Dale's Hybrid also showed a certain amount of resistance, but the only other variety approaching May in this respect was Weibull's Immuna.

SCHILLE (H.). **Erddämpfung und Schwarzbeinigkeit.** [Soil steaming and black leg.]—*Obst- u. Gemüseb.*, lxxxv, 6, p. 71, 2 figs., 1939.

Black leg of cabbage (*Olpidium brassicae* [*R.A.M.*, xviii, p. 483], *Moniliopsis aderholdi* [ibid., xvii, p. 183], and *Pythium de Baryanum*) is stated to be responsible for losses of 30 per cent. or more of the crop in the Bonn district of Germany, where excellent control is given by steam sterilization of the soil.

ESCHKILSEN (L. W.). **Dusting and spraying Sugar Beets.**—*Proc. Amer. Soc. Sug. Beet Technol., East. Div., 1939*, pp. 16–20, 1939. [Abs. in *Facts ab. Sug.*, xxxiv, 8, p. 34, 1939.]

During the period from 16th July to 2nd September, [? 1938], a mobile dusting outfit consisting of two Bean power dusters mounted on small trucks moved from farm to farm under the auspices of the Great Lakes Sugar Company to conduct operations against beet leaf spot (*Cercospora*) [*beticola*: *R.A.M.*, xviii, p. 566]. The mixture used consisted of lime and copper sulphate (4:1), applied at the rate of about 40 lb. per acre at each dusting, the work being carried on at night. The

area covered by the two machines in a ten-hour shift ranged from 86 to 157 acres.

To cite an example of the results, in a field of 16·44 acres dusted on 9th and 22nd August and 2nd September, the treated beets yielded 14·23 net tons per acre as against 11·76 for the untreated, the sugar contents being 17·8 and 16·1 per cent., respectively, and the sugar production per acre approximately 4,817 and 3,539 lb., respectively. The colour of the dusted leaves rapidly changed from pale to dark green following the application of the mixture. Allowing 50 to 60 cents per acre for the soil improvement value of the lime used, the cost of the three anti-leaf spot treatments was just over $4, which may be regarded as a reasonable insurance against yield reduction.

CALLAND (J. W.). **Dusting Sugar Beets in the Decatur Territory, 1939.**—*Proc. Amer. Soc. Sug. Beet Technol., East. Div., 1939,* pp. 20–23, 1939. [Abs. in *Facts ab. Sug.*, xxxiv, 8, p. 34, 1939.]

Two Bean self-mixing power dusters, equipped to dust twelve rows at a time, applied a Bordeaux dust consisting of $12\frac{1}{2}$ lb. monohydrated copper sulphate and 50 lb. hydrated lime to sugar beets [for the control of *Cercospora beticola*: see preceding abstract] in the Decatur Territory at the rate of 30 to 35 lb. per acre at 10- to 14-day intervals between 19th July and 30th August, followed by a fourth treatment in six fields during the first week in September. The outfit dusted an average of 60 acres in a ten-hour day, the cost per acre of one treatment being reckoned at $1·30. No difference in the results was observed between day and night applications. The average acre yields of the 580 acres treated three times were 7·32 and 6·42 tons for the treated and untreated beets, respectively, the corresponding figures for sugar content being 16·85 and 15·45 per cent. and sugar production per acre 2,269 and 1,825 lb., respectively. It is estimated that the 444 lb. gain in recoverable sugar, together with the extra pulp, would represent a value to the farmer of $8·34 at present prices. By 1st August, according to local observations, it should be possible to forecast with fair accuracy the probable extent of leaf spot damage in a given year.

BRONNER (G.). **Zur Bekämpfung der Blattfleckenkrankheit bei Zuckerrüben. Sechs Jahre praktische Erfahrungen in Oberösterreich.** [On the control of Sugar Beet leaf spot disease. Six years' practical experience in Upper Austria.]—*Dtsch. landw. Pr.*, lxvi, 19, pp. 237–238; 20, pp. 247–248, 7 figs., 1939.

Details are given of the writer's six-year campaign against leaf spot of sugar beets (*Cercospora beticola*) in the fields supplying the Enns sugar factory, Linz, Upper Austria [*R.A.M.*, xviii, p. 566]. In preliminary trials in 1934, four applications of Bordeaux mixture resulted in an average yield increase of 35 doppelzentner [3,500 kg.] per hect. In 1935 comparative spraying and dusting experiments were carried out, the former with 40 per cent. copper oxychloride and the latter with 10 per cent. cuprispora Mantov [ibid., xvi, p. 362]; in the two following years dusts from the firms of Skoda-Wetzler and Bayer were also used with good results. Five fortnightly dry and four liquid treatments at 20-day intervals were given. In 1937 only 2 per cent. of the total area

was treated with dusts owing to the various inconveniences of the method, and in 1938 it was discontinued in favour of the cheaper and more uniformly reliable spraying, the total cost of which is estimated at RM. 48 per hect. The average reduction in the yield of roots due to *C. beticola* from 1932 to 1937, inclusive, was 4,000 kg. per hect., valued at RM. 140, the corresponding figure for the foliage being RM. 50. Taking the cost of the treatment as equivalent to the value of 1,400 kg. beets, it is evidently more than repaid by the augmented production. In 1937, moreover, when 87 per cent. of the area under beets was sprayed, the sugar content was 5,200 kg. per hect. compared with 3,400 in 1932, a season of similar climatic conditions when no treatments were applied. Until it is possible to develop an immune variety adapted to the Upper Danube valley the spraying campaign must be continued without relaxation: for 1939 the area registered for treatment amounted to 96 per cent. of the total.

NELSON (R.). **Tests for new dust and liquid fungicides in 1938 for control of Celery leaf blights.**—*Quart. Bull. Mich. agric. Exp. Sta.*, xxi, 4, pp. 295–307, 1939.

In further comparative dusting tests in Michigan against early and late blight of celery (*Cercospora apii* and *Septoria apii-graveolentis*) [*R.A.M.*, xvii, p. 722; xviii, p. 291] the best results obtained in experiments on three farms at Comstock were given by cuprocide No. 1 (7 lb. cuprocide, 30 lb. sulphur, and 63 lb. talc), which reduced the number of blight spots per leaflet from an average of 21·4 to one of 7·7 in the first experiment (9 applications), from 37 to 6·4 in the second (16) and 44·8 to 7·2 in the third (10).

The cuprocide dusts were superior to the others in flowing qualities, and the uniform discharge and maximum dispersion of the particles gave a degree of coverage not attained with any dust previously tested. The adhesiveness but not the fungicidal effectiveness of the dusts was increased by the use of stickers. Basicop-sulphur-talc and Bordow-sulphur-talc were less satisfactory, being about as effective as the monohydrated copper sulphate-hydrated lime (20–80) and copper sulphate-lime-talc mixtures.

In a comparative test with Bordeaux mixture 8–12–100 and 8–6–100 and various copper sprays, the former gave the best results, reducing infection from an average of 76·89 spots per leaflet to 1·38 and 1·90, respectively, without causing perceptible injury. Local growers who use liquid fungicides are again advised to rely on standard 8–12–100 Bordeaux mixture for the control of celery leaf blights.

MORRIS (L. L.) & PLATENIUS (H.). **Low temperature injury to certain vegetables after harvest.**—*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 609–613, 3 figs., 1939.

The low temperature injury of cucumbers known as pitting is characterized by the formation of numerous circular pits, 3 to 10 mm. in diameter and less than 1 mm. deep, which may combine to form large, irregular, sunken areas. Experiments are described which showed that pitting occurred on cucumbers stored at all temperatures between 33° and 60° F., but that, other factors remaining constant, injury became

progressively less severe as the storage temperature was raised. The relative humidity of the storage room exerted a marked effect on rate of pitting at any one temperature, severity being inversely proportional to relative humidity. Thus, at 32° to 36° and relative humidities of 50 to 54, 70 to 75, and 90 to 100 per cent., pitting after nine days was, respectively, severe, moderate, and very slight. At all temperatures from 39° to 61° no pitting developed after seven days at relative humidities of 95 to 100 per cent. At 39° to 42° pitting was severe at 50 to 60 per cent. humidity and moderate at 79 to 88; at 49° to 50° it was moderate at 50 to 55 per cent. and absent at 81 to 90; and at 60° to 61° it was very slight at 50 to 60 per cent. and absent at 81 to 90.

Almost identical results were obtained with California Wonder peppers [*Capsicum annuum*]. Low temperature injury was also produced on eggplants, watermelons, summer and winter squashes, pumpkins, snap beans [*Phaseolus vulgaris*], and celery held at an average temperature of 35° in low relative humidity.

Typical pitting was produced in cucumbers stored even at 70° when kept for one week in a closed container in which the atmosphere was replaced twice daily by the introduction of pure nitrogen. The evidence obtained indicated that the final stage of low temperature breakdown in cucumbers is a localized desiccation near the epidermis.

Bailey (R. M.). **Progress in breeding Cucumbers resistant to scab (Cladosporium cucumerinum).**—*Proc. Amer. Soc. hort. Sci.*, xxxvi, pp. 645–646, 1939.

Data obtained in further work in Maine on breeding cucumbers for resistance to *Cladosporium cucumerinum* [*R.A.M.*, xviii, p. 651] supported the view that monogenic inheritance is involved in major resistance in inbred lines and crosses. The degree of resistance varied slightly in crosses, indicating that it may perhaps be influenced by secondary factors. Resistance appeared to be incompletely dominant to susceptibility.

Eighteen cultures of the fungus were made from an equal number of diseased fruits found in widely separated localities in Maine, and seedlings of resistant inbreds and susceptible varieties were inoculated with each strain. One was found to be non-pathogenic, but no significant difference in pathogenicity was shown by the remainder. That troublesome physiologic strains of the fungus are not present in New England was further indicated by growers of Maine No. 2 cucumber, a selection recently released for home garden use. Of 55 reports on this variety, 46 stated it showed no scab, eight a trace, and one (under further investigation) reported considerable infection, while of 41 reports on other varieties by the same growers only eight showed no scab.

The evidence indicated that resistance is either independent of, or so loosely associated with, spine and fruit colour, and shape and size of fruit, as not to cause any serious interference with practical breeding.

Sarazin (A.). **Cultures monospermes d'Agaricus campestris var. cultivée.** [Monospore cultures of the cultivated variety of *Agaricus campestris*.]—*C.R. Acad. Sci., Paris,* ccviii, 25, pp. 2015–2017, 3 figs., 1939.

Monospore cultures of *Agaricus* [*Psalliota*] *campestris* were obtained

by selecting from a germinating spore layer single individuals with incipient germ-tubes and transferring them separately with a de Fonbrune micromanipulator to Van Tieghem cells. The most vigorous of these cultures produced carpophores a week earlier than the mass controls, and the mature mushrooms were found to have reverted to the original growth habit of the variety, viz., a broad, spreading cap and squat stipe, features that had been quite lost in the ordinary methods of cultivation.

BERNON (G.). **Recherches sur la coulure.** [Investigations on 'coulure'].—*Progr. agric. vitic.*, cxi, 11, pp. 247–254, 3 figs., 2 graphs, 1939.

The results of studies briefly reported in this paper are considered to indicate that in the French vine variety Clairette, highly susceptible to 'coulure' [*R.A.M.*, x, p. 640], the malady is mainly due to low vitality of the pollen, associated with too vigorous growth of the vegetative organs. The trouble may be controlled by making annular incisions at the base of the fruiting shoots, removing the growing points, and applying to the flowers pollen from other varieties.

England and Wales: new and interesting phytopathological records for the year 1938.—*Int. Bull. Pl. Prot.*, xiii, 7, pp. 153M–154M, 1939.

Fungi recorded in England and Wales for the first time in 1938 included *Oidium begoniae* [*R.A.M.*, xvi, p. 299] on the lower leaves of begonias under glass, *Haplobasidium pavoninum* causing leaf blotch of a seedling *Aquilegia*, and *Sclerotinia bulborum* [ibid., v, p. 14] on L'Innocence hyacinth bulbs grown in Lincolnshire and on a single imported hyacinth bulb, while the following constitute new host records: *Armillaria mellea* on carrot and lavender, *Sclerotium tuliparum* [ibid., xvii, p. 531] on crocus, *Thielaviopsis basicola* on *Daphne mezereum* and scabious [*Scabiosa*], and *Ustilago vaillantii* on *Muscari botryoides* and *Scilla verna*.

CONNERS (I. L.). **Eighteenth Annual Report of the Canadian Plant Disease Survey, 1938.**—xii+112 pp., 1939. [Mimeographed.]

During 1938, wheat stem rust (*Puccinia graminis*) proved destructive in Manitoba, eastern Saskatchewan, the maritime provinces of Canada, and Quebec [cf. *R.A.M.*, xvii, p. 796]. Only about 14 per cent. of the wheat acreage in Manitoba was sown to susceptible varieties and the resistant Renown and Thatcher showed only slight traces of rust.

Wheat leaf rust (*P. triticina*) was exceptionally prevalent in western Canada, Thatcher being the most severely attacked commercial variety. Renown was less heavily infected, while Marquis, Reward, and Ceres were intermediate. The disease considerably reduced the yield of all varieties (35 or more per cent. in the case of Thatcher in some areas).

Crown rust of oats (*P. coronata*) was prevalent in eastern Saskatchewan and Manitoba, and in most of eastern Canada, though less destructive than in 1937. Further evidence was secured that buckthorn (*Rhamnus cathartica*) plantings are responsible for serious outbreaks. Crown rust apparently possesses greater powers of spread than stem rust and a few *R. cathartica* bushes suitably situated may set up an epidemic of *P. coronata* over a relatively large area.

Botrytis cinerea was isolated from oat head blight in Nova Scotia and New Brunswick, apparently the first record on oats. *Fusarium graminearum* [*Gibberella saubinetii*] (a species seldom found in Canada) was isolated from head blight of wheat in the maritime provinces.

Ergot (*Claviceps purpurea*) became a problem in wild rice (*Zizania aquatica*) in northern Manitoba, where the crop, owing to its failure in Minnesota, was of considerable commercial value.

Leaf spot (*Stemphylium sarcinaeforme*) [ibid., xviii, p. 141] occurred on red clover (*Trifolium pratense*) at Macdonald College, Quebec, the first record of this fungus for Canada, though it is commonly found in New York State.

Potato bacterial wilt and rot (*Phytomonas sepedonica*) [*Bacterium sepedonicum*: ibid., xviii, p. 612] was destructive in Quebec and was found in an even larger number of fields in New Brunswick. It was noted for the first time (in one or a few fields) in Alberta, Saskatchewan, Manitoba, Ontario, and Prince Edward Island. The smear method proved very useful in showing the presence of the organism in suspected tubers, and it is expected that the use of this method will expedite the elimination of diseased stocks.

Purple top wilt [ibid., xvii, p. 700] widely affects potatoes in the prairie provinces, but seldom causes more than a trace of damage.

Vegetable diseases noted included bacterial blight of carrot (*Phytomonas* [*Pseudomonas*] *carotae*) [ibid., xiv, p. 211], first observed in 1935, and found in 1938 at Brandon and near Winnipeg. Bacterial blight (*Phytomonas* [*Bact.*] *phaseoli*) [ibid., xvii, p. 369] caused an estimated loss of $50,000 in the bean [*Phaseolus vulgaris*] crop in the irrigated areas of southern Alberta. In the Niagara Peninsula, Ontario, *Phomopsis vexans* [ibid., xviii, p. 370] was destructive to eggplants. Radishes in Quebec were affected by black root (*Aphanomyces raphani*) [ibid., xv, p. 420], a new record for Canada. Anthracnose (*Colletotrichum phomoides*) [ibid., xvi, p. 419], not infrequent on imported tomatoes, was epidemic in Essex and Kent counties, Ontario, greatly reducing the quantity of marketable fruit.

Apple fireblight (*Erwinia amylovora*), locally destructive in 1938 in most parts of Canada, has never been reported from Alberta or the famous commercial orchards of the Annapolis valley, Nova Scotia, but some damage was caused to nursery stock in the latter province by what appeared to be this disease. Drought spot or corky core [internal cork: ibid., xvii, p. 465; xviii, p. 117] is not now a problem in orchards given soil treatments with boric acid in British Columbia, where applications made in 1936 were still fully effective in 1938.

Picea rubra at St. Martins, New Brunswick, was affected by needle rust (*Chrysomyxa weirii*), apparently the first record of this rust in eastern Canada.

New diseases of ornamental plants and important extensions of range or host included bacterial leaf spot of greenhouse carnations in Ontario due to *Phytomonas* [*Bact.*] *woodsii* [ibid., xvii, p. 728], a new record for Canada. Corm rot (*F. oxysporum* var. *gladioli*) [ibid., xvi, p. 335] affected gladiolus at Winnipeg, a new disease on this host in Canada. Iris at Summerland, British Columbia, was affected by *Botrytis* rhizome rot (*Sclerotinia convoluta*) [ibid., xvi, p. 751]; the only previous record of

this disease in Canada was in 1927. Powdery mildew (*Microsphaera alni*) [ibid., xvii, p. 754] was found on privet, a new host for this fungus, in Ontario and Prince Edward Island. Bacterial blight (*Phytomonas* [*Bacterium*] *papavericola*) [ibid., ix, p. 456] was recorded in British Columbia on Tibetan poppy (*Meconopsis baileyi*), a new host for the organism, and a new disease for Canada. *Phytophthora cactorum* caused tulip blossom blight in Ontario, and dark berry of *Cotoneaster horizontalis* on Vancouver Island. Crown rot (*Phytomonas* [*Bact.*] *delphinii*) was found on a new host, *Aconitum*, in Manitoba.

[A survey of the new or noteworthy diseases (pp. ii–vi) is given in *Int. Bull. Pl. Prot.*, xiii, 9, pp. 201–204, 1939.]

Brien (R. M.). **A list of plant diseases recorded in New Zealand.**—*Bull. N.Z. Dep. sci. industr. Res.* 67, 39 pp., 1939.

This is a list, arranged alphabetically under the botanical names of the hosts, of 411 plant diseases recorded, for the most part since 1920 and some for the first time, in New Zealand. Literature references and an index of pathogens and physiological diseases are appended. Among new records the following may be mentioned: *Botrytis allii* [*R.A.M.*, xviii, p. 43] on, and yellow dwarf (*Allium* virus 1 of Smith) [cf. ibid., xvii, p. 576] of, onion, mosaic (*Cucumis* virus 1) of cantaloupe, vegetable marrow, and cucumber, *Entyloma dahliae* on cultivated dahlia [ibid., xvii, p. 752], *Sclerotium* [*Sclerotinia*] *gladioli* [see above, p. 712] on cultivated *Gladiolus*, *Phoma destructiva* and *Phytophthora cryptogea* on tomato, and *Botrytis tulipae* on, and break (*Tulipa* virus 1) of, cultivated tulips.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, l, 7, pp. 367–371, 4 figs., 1939.

Fusarium wilt of tomatoes [*F. bulbigenum* var. *lycopersici*: *R.A.M.*, xviii, p. 557] would be a serious disease in New South Wales but for the resistance shown by most of the commercially grown varieties. Under ordinary field conditions, Red Marhio, Break O'Day, Marglobe, and Australian Earliana are highly resistant. The chief heated-glass-house variety, Planter's Favourite, is also resistant, while Potentate, Rutgers, and Antibes are promising new varieties showing resistance. Bonny Best, strains of Earliana other than Australian Earliana, and the Chinese types grown in unheated greenhouses are very susceptible.

Owing to exceptionally humid weather, unusually large numbers of navel oranges and other citrus fruits in coastal orchards in New South Wales became infected by green and blue moulds (*Penicillium digitatum* and *P. italicum*, respectively). The chief avenue of infection was found to be minute punctures made by fruit flies when depositing eggs in the rind. Although fruit-fly eggs laid in green orange fruits seldom develop any further, the presence of the stings alone was enough to aid infection under the climatic conditions prevailing.

Cuprinol gave very satisfactory results in preventing mould decay (due to *Cladosporium*, *Stemphylium*, *Alternaria*, *Aspergillus*, *Penicillium*, *Torula*, and other fungi) in linen and cotton fabrics, trebling the life of tent-fly canvas. The cloth is rolled into a small bundle and immersed for about one minute in undiluted cuprinol. The bundle is then

removed, allowing surplus liquid to drain back into the container, and is finally spread out to dry for two or three days.

Storey (H. H.). **Plant pathology.**—*Rep. E. Afr. agric. Res. Sta., 1938*, pp. 13–19, 1939.

In this report [cf. *R.A.M.*, xviii, p. 373] the results so far obtained in the author's study on the mechanism of transmission of streak disease of maize by *Cicadulina mbila* are summed up on the basis of papers already published [ibid., xviii, p. 245] or pending publication, and the scope of further research is indicated. Several inbred lines of maize, selected from the Peruvian Yellow Flint and Hickory King varieties and tested at Amani under controlled infection by *C. mbila*, showed a high resistance to the streak virus and are expected, although poor producers themselves, to provide valuable material for breeding work.

In connexion with the breeding of cassava strains for resistance to mosaic [ibid., xviii, p. 574], a number of promising hybrids from crosses between cassava and either Ceara rubber [*Manihot glaziovii*] or *M. dichotoma* and from some 300 crosses between the more resistant cassava varieties have been multiplied at Amani and encouraging results have so far been obtained with inter-specific hybrids.

An investigation of a suspected virus disease of passion fruit in Kenya, stated to resemble in its typical form the 'woodiness' disease in Australia [ibid., xvii, p. 730], led to the conclusion that there are several forms of the disease, some of which have not yet been transmitted to healthy plants, while in one form the presence of a virus was demonstrated by successful transmission through juice transfer and through the use of a contaminated pruning knife. It is suggested that the most hopeful line of work would be the selection of a resistant strain either within the species, *Passiflora edulis*, or, more probably, among inter-specific hybrids.

Fifty-first Annual Report of the Rhode Island State College Experiment Station.—64 pp., 1939.

In this report on plant disease work on Rhode Island in 1937–8 [cf. *R.A.M.*, xviii, p. 442] it is stated that when Baldwin and McIntosh apple leaves were immersed for identical periods at different times from 7 a.m. to 7 p.m. in lime-sulphur (1 in 50), lead arsenate, and hydrated lime, singly and in different combinations, with most of the sprays, but especially lime-sulphur, burning became progressively greater with increasing lateness of treatment up to 1 p.m., after which it declined, reaching a minimum at 7 p.m. [cf. ibid., xviii, p. 686].

Rhode Island Greening apples picked on 1st, 9th, 16th, 23rd, and 30th September, when examined in March showed, respectively, 11, 64, 71, 55, and 55 per cent. free from scald, the corresponding figures for smaller fruits from 35-year-old trees in another orchard being 89, 96, 100, 100, and 100 per cent. Cortland apples from the former orchard picked on 16th, 23rd, and 30th September, and 7th and 14th October showed, respectively, 5, 21, 83, 93, and 100 per cent. freedom from scald. There would appear to be a definite relationship between the development of scald and time of picking.

Cabbages in soil where this crop had previously been affected by

club root [*Plasmodiophora brassicae*: ibid., xviii, p. 443] showed only 4 per cent. infection following soil treatment with chloropicrin, as against 45 per cent. for those in the untreated soil.

Bonnie Best tomatoes treated against *Phytophthora infestans* and *Alternaria solani* with seven applications of cuprocide-celite dust (one part cuprocide, seven parts celite, one part wheat flour, and one part calcium arsenate by weight) and eight applications of Bordeaux mixture (4–4–50) gave yields of 456 and 383 bush. per acre, respectively, as against 236 bush. per acre for the untreated control, the corresponding figures for the Rutgers variety being 438, 489, and 290 bush. per acre.

In a varietal resistance trial against *Peronospora schleideniana* [ibid., xiv, p. 647] the onion varieties Italian Red Bottle, White Sweet Spanish, Riverside Sweet Spanish, Grano, and Early Sweet Spanish showed, respectively, 95, 75, 60, 50, 10, and 5 per cent. uninjured leaves.

When Cobbler and Green Mountain potatoes were sprayed against late blight [*Phytophthora infestans*] four times with various Bordeaux mixtures the best result was given by Bordeaux mixture (8–8–50) with only 24 and 1 per cent. infection for the two varieties, respectively, as against 100 and 64 per cent. infection for the unsprayed controls.

Schoorel (A. F.). **Beknopt overzicht van de Rubber- en Theecultuur in het rayon Sokaboemi gedurende 1938.** [A concise report on Rubber and Tea cultivation in the Sokaboemi district during 1938.]—*Bergcultures*, xiii, 22, pp. 739–740, 1939.

The red and white root rots [*Ganoderma pseudoferreum* and *Fomes lignosus*: *R.A.M.*, xviii, p. 579] of rubber [*Hevea brasiliensis*] in the Sokaboemi district of West Java were well controlled by the routine method of trenching, though new cases developed in proximity to tea and *Albizzia falcata*. The roots of *Centrosema pubescens* in an infected trench were found to be free from red rot.

Of the various fungi observed in tea plantations *G. pseudoferreum* [loc. cit.] is stated to be virulent locally. Diseased *A. falcata* roots constitute the main source of recurrence of infection by *G. pseudoferreum*, and should be removed from a radius of 10 m. round the trenches. The incidence of grey blight (*Pestalozzia*) [*theae*] is stated to be steadily increasing, especially on chemically poor, weathered, red laterite soils.

Heubel (G. A.). **Beknopt overzicht van de ondernemingscultures in het rayon Zuid-Sumatra gedurende 1938.** [A concise report on the plantation crops in the south Sumatra area during 1938.]—*Bergcultures*, xiii, 23, pp. 768–782, 2 graphs, 1939.

White root rot [*Fomes lignosus*] is the only disease of importance in rubber [*Hevea brasiliensis*] plantations on sandy white soils in south Sumatra, where the same parasite also occurs on impermeable clay soils, sometimes in conjunction with red rot [*Ganoderma pseudoferreum*: see preceding abstract]. Brown root rot [*F. noxius*] appears to be present only in volcanic soils [ibid., xviii, p. 137]. Discussing the control of these root rots (by the usual methods of root exposure and encirclement of the diseased and adjacent trees by trenches), the writer

mentions that in a clearing on volcanic soil the thick lateral rubber roots were still alive three years after the eradication of the stumps, a point of considerable importance in connexion with the risk of infection from this source.

Good control of mouldy rot [*Ceratostomella fimbriata*] was given by the application to the tapping surfaces of Socony product 2295 A mixed with 5 to 10 per cent. carbolineum [ibid., xviii, p. 579].

The incidence of bark or foot rot [ibid., xvi, p. 798] has been greatly reduced by the adoption of a rational tapping system, in which the iron latex cup supports are replaced by rattan or bamboo cords and stringent precautions are taken against the infliction even of slight injuries.

Mildew [*Oidium heveae*] was generally mild and no special treatment was required to control it, but in the Lower Palembang district infection was rather more severe than usual, especially in the BD. 5 and War. 1 monoclone blocks.

Top die-back of coffee [ibid., xvii, p. 171] developed in a severe form on an estate hitherto free from the disease. Control was effected by intensive daily pruning for 35 days. Brown root rot [*F. noxius*], originating in a sickly lamtoro [*Leucaena glauca*] cover crop, also caused much damage.

Tea was attacked by black and brown root rots (*Rosellinia arcuata* and *F. noxius*), *Colletotrichum camelliae* [*Glomerella cingulata*: ibid., xviii, p. 579], and *Pestalozzia theae*. Seedlings were affected by the 'bitten-off' disease [ibid., xvi, p. 798] on neutral to alkaline soils with a low humus content, the application of sulphur to which resulted in an improvement.

Cinchona was attacked by [unspecified] root rots, pink disease [*Corticium salmonicolor*], and stem rust [ibid., xviii, p. 579], the last-named being the most prevalent and troublesome disease of the crop at the moment. No fungi or bacteria having been isolated from the affected tissues, the writer is inclined to attribute the disorder either to a virus or to adverse physiological conditions. A species of *Rhizoctonia* was responsible for collar rot of seedlings [ibid., v, p. 193; vii, p. 308].

Pepper (*Piper nigrum*) diseases included foot rot [*Phytophthora palmivora* var. *piperis*: ibid., xvii, p. 162], and pink disease [*Corticium salmonicolor*: ibid., xiv, p. 152].

VERONA (O.). **Sul meccanismo di azione dei sali di potassio nella resistenza allo sviluppo delle malattie batteriche delle piante.** [On the mechanism of action of potassium salts in resistance to the development of bacterial diseases of plants.]—*Nuovo G. bot. ital.*, N.S., xlv, 1, pp. clxxiv–clxxviii, 1 fig., 1 graph, 1938. [Received June, 1939.]

Preliminary tests having indicated that tumours produced on *Ricinus* [*communis*] plants following inoculation with *Bacterium tumefaciens* were of less weight in plants given applications of potassium chloride, potassium sulphate, or potassium phosphate than those produced on inoculated but untreated controls, the author carried out an experiment in which *Ricinus* plants were grown in sand in pots to which were added salts of calcium, potassium, sodium, magnesium, and ammonium, alone or in various combinations, or powdered sulphur, untreated pots being

left as controls. The plants were inoculated with *Bact. tumefaciens* 13 days after sowing by means of a needle puncture, and the experiment was concluded a month later, when the average fresh weight of the tumours in the fourteen series varied from 2·6 to 5·23 gm.

The data obtained are considered to indicate that the nitrates used favoured the growth of the tumours, while the chlorides and sulphates impeded it; that sulphur was unfavourable to tumour development; and that the cations had no particular effect. The beneficial effect of the potassium salts would appear to be due more to the anion than the cations.

HASSEBRAUK (K.). **Untersuchungen über die physiologische Spezialisierung des Weizen- und Haferschwarzrostes in Deutschland im Jahre 1937.** [Studies on the physiologic specialization of Wheat and Oats black rust in Germany in the year 1937.]—*Arb. biol. Anst. (Reichsanst.) Berl.*, xxii, 4, pp. 479–482, 1939.

Continuing his studies at the Gliesmarode (Brunswick) branch of the Biological Institute on physiologic specialization in the black rusts of wheat and oats (*Puccinia graminis tritici* and *P. g. avenae*) in Germany [*R.A.M.*, xvii, p. 225] in 1937, the writer recognized in 28 collections of the former, mostly from the south, the races 2, 14, 21, 23, 24, 27, 40, and 133, and differentiated three new ones, E, F, and G the reactions of which to the 12 test varieties are given.

A comparison of the wheat black rust population of 1937 with that of 1934–5 presents a totally different picture, race 14 (which appeared only once in the earlier year in a Greek collection) predominating in the later year, while conversely, 40 (the principal source of inoculum in 1934–5) was found in only one lot of material from Baden in 1937. Race 21, formerly common, was also rare in 1937, developing only in two collections from the Ulm district. Except for 24, observed by Dodoff in Bulgaria in 1934 [ibid., xiii, p. 500], all the other races identified in 1937 are new for Europe.

The physiologic races of *P. g. avenae* occurring in 1937 in collections were 1, 1a (differing from 1 in its failure to attack Joanette Strain), 2, 4, 6, 8, and a new race 11, producing severe infection on Richland and Victory, while White Russian was moderately resistant and Joanette Strain practically immune. The latter variety has further maintained a high degree of resistance to races 1 and 4. Races 6 and 11 preponderated. As in the case of *P. g. tritici*, the 1937 population of *P. g. avenae* showed considerable differences as compared with that of 1934–5, though the paucity of material available for investigation in both years prevents any definite conclusion as to the actual incidence of the various races. It would appear, however, from the information at present to hand that Europe is richer than the United States in physiologic forms of black rust of oats.

MCFADDEN (E. S.). **Early Blackhull resists stem rust in Texas.**—*Phytopathology*, xxix, 7, pp. 644–645, 1939.

In tests conducted in experiment stations in Texas Early Blackhull winter wheat has shown a high degree of early resistance to stem rust (*Puccinia graminis tritici*), remaining consistently almost unaffected for

about two weeks after other varieties that head at the same time have become heavily diseased. About a week or ten days before ripening Early Blackhull generally shows a light to moderately abundant infection of small, isolated pustules. This behaviour has been consistent in the presence of races 1, 11, 17, 21, 24, 36, 38, 49, 50, and 56, so that either the variety possesses early resistance to several races or the fungus requires a long incubation period on it.

In crosses between Early Blackhull and varieties carrying the Hope type of mature-plant resistance to stem rust, an occasional F_2 plant remained entirely rust-free early and late under conditions in which both parents became heavily infected. Early Blackhull would seem to be of much value as a parent for breeding purposes.

HASSEBRAUK (K.). **Untersuchungen über den Einfluss einiger Aussenfaktoren auf das Anfälligkeitsverhalten der Standardsorten gegenüber verschiedenen physiologischen Rassen des Weizenbraunrostes.** [Studies on the influence of some external factors on the susceptibility reaction of the standard varieties to various physiologic races of Wheat brown rust.]—*Phytopath. Z.*, xii, 3, pp. 233–276, 1939.

The standard assortment of wheat varieties used for the determination of physiologic specialization in brown rust (*Puccinia triticina*) [*R.A.M.*, xvii, pp. 226, 663; xviii, p. 299], viz., Malakoff, Carina, Brevit, Webster, Loros, Mediterranean, Hussar, and Democrat, together (in some of the tests) with various other varieties, were inoculated in the seedling stage at the Gliesmarode (Brunswick) branch of the Biological Institute with various races of the pathogen, left covered for 48 hours, and then exposed to varying environmental conditions.

As a rule low temperatures (e.g., a mean of 6° C. as compared with the normal of 20°) intensify susceptibility to *P. triticina*, but certain varieties, Carina and Brevit, for instance, consistently react by increased resistance. In other cases the response of a given variety to a drop in temperature may depend on the physiologic race used for inoculation. Usually continuous maintenance under bell-jars either makes no difference to varietal reaction or increases resistance, but Carina and Brevit (also Hussar in poor soil) acquire enhanced susceptibility to certain races of the rust in these conditions. The two first-named varieties are similarly affected by a curtailment of the normal light supply which ordinarily tends, if anything, to increase resistance. They further deviated from the other standard varieties in the development of a marked weakening of resistance (x type of infection) as a result of nitrogen deficiency, in older leaves especially.

The investigations showed that such environmental aberrations are calculated to preclude a reliable identification of races 10, 19, 9, C, 17, 13, 20, and 31 of *P. triticina* by present methods. It is of great importance, therefore, to maintain optimal external conditions in specialization studies, and in this connexion the question of the substitution of more uniformly reacting varieties for the very unstable Carina, Brevit, and Hussar also demands careful consideration. Another point of interest arising from these observations is the varying influence of

surrounding conditions on the type and incidence of infection, these two factors being by no means consistently affected either in the same direction or to a like extent.

SĂVULESCU (T.) & SANDU-VILLE (C.). **Încercări pentru stabilirea raselor fiziologice la cele două specii de Tilletia ce produc malura Grâului în România.** [Investigations on the physiologic races of two species of *Tilletia* causing bunt of Wheat in Rumania.]—*Anal. Inst. Cerc. agron. Román.*, x (*1938*), pp. 518–631, 1939. [German summary.]

Of the two species of *Tilletia* causing bunt of wheat in Rumania, *T. foetens* [*R.A.M.*, xvii, p. 655] is stated to be more prevalent than *T. tritici* [*T. caries*: loc. cit.]. Collections of the two species from all parts of the country were separated on the basis of their virulence to a test assortment of ten wheats into ten physiological races, five of *T. foetens* and five of *T. caries*, race V being in each case the most virulent, race I the least, and races II, III, and IV intermediate. Among the five races of *T. caries* race V is the most frequently found, followed by race IV. Races I and II differ from the others, apart from being less virulent, in that their spores measure 19·28 to 19·97 μ in diameter, while those of the other three races measure 16·9 to 18 μ. Two races of *T. caries*, named X and Y, were found on the introduced variety Rimpau's Early Hybrid and Varonne, race X approximating to race II in virulence but having larger spores, and race Y, which was also found on a sample of *Triticum monococcum* from Şona, approximating to race IV in virulence but again having larger spores. Among the five races of *T. foetens*, which show no divergence in the size of spores and are differentiated only by the degree of virulence, the most frequent is race III; in some districts this is the only one present. It is pointed out that the above-described races are not physiologic races in the strict systematic sense, each constituting, probably, a complex of races, which could be separated by using a larger test assortment and conducting cultural experiments on artificial media.

FISCHER (G. W.). **Studies on the susceptibility of forage grasses to cereal smut fungi. III. Further data concerning Tilletia levis and T. tritici.** —*Phytopathology*, xxix, 7, pp. 575–591, 2 figs., 1939.

Continuing his investigations [*R.A.M.*, xviii, p. 665], the author carried out inoculation experiments which showed that *Agropyron inerme*, *A. spicatum*, *A. trichophorum*, and *Sitanion jubatum* may act as hosts to *Tilletia levis* [*T. foetens*] and *T. tritici* [*T. caries*].

When 20 selections of *A. cristatum* and 16 of *A. pauciflorum* were each inoculated with each of 8 races of *T. foetens* and 11 of *T. caries*, on *A. cristatum* some races of *T. foetens* (such as L–3 and L–6) and some of *T. caries* (such as T–2 and T–8) were several times as virulent as others, such as T–1, T–3, T–9, and T–11 [ibid., xvii, p. 165]. On *A. pauciflorum* the differences in relative virulence were even greater, race T–10 being 10 to 14 times as virulent as races L–7, T–6, and T–11. *T. foetens* appears to be about 35 per cent. more virulent than *T. caries* on *A. cristatum*, and slightly less virulent on *A. pauciflorum*.

While none of the selections of *A. cristatum* was entirely immune from

T. foetens, a few were highly resistant, and several were moderately susceptible, with average percentages of infection ranging from 24 to 32 per cent. One selection of *A. cristatum* appeared to be immune from *T. caries*, some were highly resistant, and others were moderately susceptible. Eight of the 16 selections of *A. pauciflorum* appeared to be immune from all eight races of *T. foetens*, only two were moderately susceptible, and the rest were more or less resistant. Selections resistant to *T. foetens* were, in general, also resistant to *T. caries*. One selection was susceptible to all 11 races of *T. caries*. As a species, *A. cristatum* is more susceptible to wheat bunt than *A. pauciflorum*.

The evidence obtained indicated that the mycelium of *T. foetens* and that of *T. caries* are perennial in perennial hosts, but not indefinitely so, the number of infected plants in nursery rows becoming less each year.

Inoculation experiments with bunt balls of *T. caries*, found in sweet clover seed but obviously originating from some grass, indicated that the collection belonged to race T–8.

In the author's experiments, plants infected by *T. caries* tended to be stunted.

SANFORD (G. B.). **Research on certain soil-borne diseases as affected by other micro-organisms.**—*Sci. Agric.*, xix, 10, pp. 609–615, 1939.

This is a discussion on the problems of soil-borne diseases, chiefly root rots of wheat (*Ophiobolus graminis*, *Helminthosporium sativum*, and *Fusarium culmorum*), as affected by antibiosis and related phenomena, based on the author's own and other workers' experiments [*R.A.M.*, x, pp. 417, 719; xi, p. 169; xii, p. 18, *et passim*]. The results obtained in this research suggest that certain soil-borne pathogens are attacked and sometimes destroyed by antagonistic micro-organisms. It is pointed out, however, that this antagonistic action is very complex in natural soil and may be weaker than in sterilized soil or on synthetic media. Some recently discovered growth-promoting substances produced by plants or micro-organisms, such as pantothenic acid (found by R. J. Williams *et al.* to be widely distributed in the cells of animals and plants—*J. Amer. chem. Soc.*, lv, pp. 2912–2927, 1933) and others, may also play an important part in the persistence of the pathogen. The need for careful research on the pertinent problems is emphasized and various questions of importance arising out of this work are briefly reviewed.

STEWART (A. M.), TEAKLE (L. J.), & THOMAS (I.). **Recent experiments with 'minor' elements in Western Australia. III. Response of Wheat to copper on light lands at Wagin. IV. The effect of 'minor' elements on the growth of Wheat in other parts of the State.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xvi, 2, pp. 135–147, 4 figs., 1939.

The work described in the first of these papers (by Stewart and Teakle) has already been noticed from another source [*R.A.M.*, xviii, p. 547]. In the second paper Teakle and Thomas describe experiments which showed that the use of minor elements failed to improve the yield of wheat on soil types at Cleary, Salmon Gums, and Wongan Hills, and in some cases were definitely injurious.

STRAIB (W.). **Weiterer Beitrag zur Frage der Spezialisierung von Puccinia glumarum (Schm.) Erikss. et Henn.** [A further contribution to the question of specialization in *Puccinia glumarum* (Schm.) Erikss. & Henn.]—*Arb. biol. Anst.* (*Reichsanst.*) *Berl.*, xxii, 4, pp. 571–579, 1939.

For the first time the method of differentiating physiologic races of yellow rust (*Puccinia glumarum*) of wheat and barley [*R.A.M.*, xviii, p. 512] was supplemented at the Gliesmarode (Brunswick) branch of the Biological Institute by tests of uredospore germination, the outcome of which indicated that, in general, divergences of germinative capacity are correlated with differences of infectivity. In addition to the widespread race 23 of *P. glumarum* on barley, another (46) was isolated from German and Bulgarian material, while the predominant race on wheat (7) was found to be accompanied by another, 41, recognizable by its ability to attack Webster (immune from 7) in a very mild form. Two more new races of *P. glumarum* on wheat (43 and 44) originated in the Alps, not hitherto investigated for their rust flora. Another new one from Japan (42) is characterized by its severe pathogenicity to Chinese wheat. The Bulgarian wheat collections yielded races 6 and 16 of the yellow rust, not hitherto recorded from that country. Two races, namely, 45 (causing severe and moderate infection, respectively, of Fong Tien and Estanzuela 75 barley, Heil's Franken being immune) and 47 from *Agropyron repens*, were separable from 46 and 28, respectively, only on the basis of differences in uredospore germination.

These data are considered to denote the importance of progressive mutation in the origin of new yellow rust races.

STANDEN (J. H.). **Prevalence of Basisporium gallarum in arrested axillary shoots and secondary ears of Maize.**—*Phytopathology*, xxix, 7, pp. 656–657, 1939.

Infection of arrested axillary shoots of maize by *Basisporium gallarum* [*Nigrospora* spp.: *R.A.M.*, xvii, pp. 519, 670; xviii, p. 18] was first observed in Iowa in the autumn of 1937, 77 (or 42·3 per cent.) of 182 such shoots collected from different localities being attacked, though in the same year the percentage of infected ears was so low that the estimated loss due to it amounted to only 1 per cent. In 1938 infection was more general, and extensive examination of arrested axillary shoots in the autumn showed average infection in open-pollinated dent maize, inbred lines, and single crosses, of 65·51 to 80·59 per cent. Secondary ears were more frequently infected than primary ones; of 604 paired primary and secondary ears in three localities 307 secondary and only 13 primary ears were infected. Of 97 secondary ears whose weight exceeded $\frac{7}{10}$ that of the respective primary ear, only 5 were infected, whereas 273 secondary ears, none exceeding one-third of the weight of the respective primary ear, included 191 infected ears. Arrested axillary shoots and poorly developed secondary ears are evidently the most susceptible tissues of the maize plant, and their extensive infection produces abundant inoculum in sites adjacent to a large percentage of the primary ears.

Perry (J. C.). **Some observations on psorosis in the light of experience of 25 years.**—*Calif. Citrogr.*, xxiv, 8, pp. 276, 290–293, 1 fig., 1939.

Data on the scraping treatment of psorosis of citrus [*R.A.M.*, xviii, p. 671] in 12 orchards in California (11 of Washington Navel and 1 of Valencia oranges) compiled during the last 25 years show that 63 per cent. of the old trees and 68 per cent. of the younger ones were still apparently cured two years after the first treatment, and 44 per cent. of either class ten years after the first treatment. Counts in the largest of the orchards during three years showed that of the total number of trees treated 13 per cent. were new cases, the remainder having been treated before. Bark symptoms rarely occurred before the sixth or seventh year after planting, and 70 per cent. of all cases originated 12 to 16 years after planting. For trees bearing a very advanced psorosis spot on only one side of the trunk a side-gouging treatment is recommended, involving cutting a vertical strip through the bark and into the wood on each side of the diseased area and then scraping the sound bark on the side of each cut slightly and the partially isolated diseased side more heavily.

Mayne (W. W.). **A note on the origin of attacks of leaf disease (Hemileia vastatrix) in Coffee estates.**—*Plant. Chron.*, xxxiv, 14, p. 417, 1939.

After pointing out that investigation has already shown that one of the chief factors determining the severity of outbreaks of coffee leaf disease (*Hemileia vastatrix*) [*R.A.M.*, xvii, p. 813] in India is the amount of affected leaf carried over during the dry period preceding the outbreak, the author states that while the last season in Mysore was very dry and very few pustules of *H. vastatrix* could be found at the Experiment Station, on 22nd June numerous well-developed pustules were discovered on a large number of trees in a moist ravine. It would appear that under very suitable conditions comparatively small areas of coffee may serve as dangerous reservoirs of infection. Where control measures against *H. vastatrix* are necessary, special attention should be devoted to these sites. If they are very small, it may be possible to remove and destroy a large proportion of the infected leaves during the dry weather before the blossom showers. Such areas should also be given an early spraying, followed by a second a month or six weeks later.

Gösswald (K.). **Über den insektentötenden Pilz Beauveria bassiana (Bals.) Vuill. Bisher Bekanntes und eigene Versuche.** [On the insectivorous fungus *Beauveria bassiana* (Bals.) Vuill. Information previously available and original experiments.]—*Arb. biol. Anst.* (*Reichsanst.*) *Berl.*, xxii, 4, pp. 399–452, 1 pl., 1939.

A detailed account of the writer's experiments with the insectivorous fungus, *Beauveria bassiana* [*R.A.M.*, xviii, p. 591], at the Biological Institute, Dahlem, Berlin, is supplemented by a useful survey of previous studies on various aspects of the organism and its effects on its hosts, and by a 15-page bibliography.

As in the case of the silkworm (*Bombyx mori*), all the ants used in the present series of trials, viz., *Lasius niger*,. *L flavus*, *L. umbratus*, *L. fuliginosus*, *Tetramormium caespitum*, and *Formica cinerea*, were destroyed to the extent of 100 per cent. at every stage of their

development, the eggs showing a striking red discoloration. The susceptibility of the following insects, not hitherto recorded as hosts of *B. bassiana*, was established by inoculations: *Cimex lectularius*, *Triatoma rubrofasciata*, *Piesma quadratum*, *Niptus hololeucus*, *Calandra granaria*, *Attagenus pellio*, *Dermestes lardarius*, *Coccinella bipunctata*, *Myzus persicae*, and *Sitodrepa panicea*, the last-named being very resistant. Of two strains of the fungus, from *Carpocapsa pomonella* and *L. niger*, the latter proved to be the more virulent. The inoculum may be introduced into ants (and bees, already known to be liable to attack by the fungus) either cutaneously or *per os* in honey or dextrose, the former method inducing a more acute type of infection.

A satisfactory culture medium for *Beauveria bassiana* was provided by potato or oatmeal agar with an admixture of diastase, trypsin, peptone, or ovomaltine, and of ground ants. The vitality of the spores was well conserved in a dry atmosphere with protection from sunlight. The hosts are destroyed both under and outside their own optimum environmental range and that of the pathogen. At 100 and 5 per cent. relative humidity the average times elapsing between inoculation and death were 7·4 and 3·1 days, respectively, the corresponding figures for 90, 75, 55, and 25 per cent. being 10·4, 9, 9·5, and 6, respectively; the incidence of mortality was 100 per cent. in all cases. At temperatures of 30°, 28°, 25°, and 20° C. the number of days required for the production of lethal effects was 6·6, 7, 7·4, and 8, respectively.

In ants the mycelium of *B. bassiana* develops only under the influence of high atmospheric humidity (optimum 100 per cent.), but in the case of larger insects, e.g., old larvae of *Bombyx mori*, it does so also under dry conditions, since the moisture of the host suffices. The same applies to the fructifications, except that here a slightly lower relative humidity is preferable. Spore production is more abundant at 25° and 20° than 30°, and mycelial growth is also particularly luxuriant at the former temperatures in conjunction with a humid atmosphere.

Among the problems discussed in connexion with the résumé of relevant literature are the technique of the fungal control of noxious insects; the economic importance of *Beauveria bassiana* for this purpose (judged to be considerable, though against this desirable attribute must be set the toxicity of the organism to useful insects, such as silkworms); the symptomatology of the pathogen and its mode of infection, in relation to which the writer found that the progeny of silkworms fed on diastase are particularly susceptible; specific reactions to *B. bassiana* in various insect groups; the taxonomy of the genus *Beauveria*; and the geographical distribution and host range of *B. bassiana* and other important species.

A special section is devoted to the fungal diseases of ants, a new pathogen of which, acting similarly to *B. bassiana*, was found in *Isaria strigosa* (on *L. niger*).

Petch (T.). **Notes on entomogenous fungi.**—*Trans. Brit. mycol. Soc.*, xxiii, 2, pp. 127–148, 1939.

This further contribution [*R.A.M.*, xvii, p. 240] includes observations on 26 entomogenous fungi, among which the following may be mentioned: a single specimen of *Empusa grylli* was found in Yorkshire

on a grasshopper, this being the first record for England. When first found on *Cordyceps entomorrhiza* the fungus *Stilbella setiformis* was assumed to be its conidial stage, but the author is now of opinion that it is identical with *S. ramosa* and is parasitic on the clava of *C. entomorrhiza*. *Tilachlidiopsis nigra* [ibid., xvi, p. 532] is similar to, but distinct from, *S. ramosa* and is a *Cordyceps* clava parasitized by a *Stilbella*. In large branched specimens of *S. ramosa* the main stem is usually that of the host, i.e., *Hirsutella* or *Cordyceps*, the lateral branches being the simple *Stilbella*.

Linford (M. B.) & Yap (F.). **Root-knot nematode injury restricted by a fungus.**—*Phytopathology*, xxix, 7, pp. 596–609, 1 fig., 1939.

A full account is given of a pot culture experiment in which pineapple plants were grown in sterilized soil infested with larvae of *Heterodera marioni* with and without the addition of cultures of the following nematode-trapping fungi: *Arthrobotrys oligospora* [*R.A.M.*, xviii, p. 675], *Dactylella ellipsospora* [ibid., xviii, p. 676], *A. musiformis* [ibid., xvii, p. 36], *Dactylaria candida* [loc. cit.], and *D. thaumasia* [loc. cit.]. During fifteen months of continuous plant growth *D. ellipsospora* restricted nematode injury to a moderate but statistically significant extent. The evidence also strongly indicated that the other fungi tested act similarly, though to a less marked degree. It is concluded that nematode-capturing fungi are beneficial members of the soil flora that should be considered when questions of nematode control arise.

Harris (L. H.). **The nature of the grain dust antigen. Crossed reactions to grain dusts and smuts.**—*J. Allergy*, x, 5, pp. 433–442, 5 diags., 1939.

Continuing his observations in Ohio on 13 patients allergic to grain dusts and smuts [*R.A.M.*, xviii, p. 679], the writer reports the data obtained in cross-testing experiments between wheat and oat dusts and smuts (*Ustilago tritici*, and *U. levis* [*U. kolleri*] and *U. avenae*). It was found that wheat dust and *U. tritici* will neutralize each other reciprocally *in vivo* and *in vitro* and probably have a common antigen, as is also in all likelihood the case with oat dusts and the two oat smuts. No evidence could be obtained, however, of any antigenic relationship between grain dusts and common moulds, such as *Alternaria*, *Helminthosporium*, or *Rhizopus* spp.

Hollaender (A.) & Emmons (C. W.). **The action of ultraviolet radiation on dermatophytes. I. The fungicidal effect of monochromatic ultraviolet radiation on the spores of Trichophyton mentagrophytes.**—*J. cell. comp. Physiol.*, xiii, 3, pp. 391–402, 4 graphs, 1939.

At the Washington Biophysical Institute spores of *Trichophyton mentagrophytes* [*R.A.M.*, xviii, p. 522], isolated from a typical case of 'athletes' foot', were suspended in a physiological salt solution and exposed at 18° C. to measured quantities of ultra-violet radiation through a wave-length range of 2,180 to 3,150 Å. The most effective region for inactivation was found to lie between 2,537 and 2,650 Å. Besides the strain 598, used in the majority of the tests and characterized by the almost exclusive production of microconidia, 2·5 to 4 by

2 to 2·5 μ, four others were investigated for their susceptibility to irradiation, viz., 597, closely resembling the foregoing; 594, forming in addition to small spores large numbers of clavate, multicellular macroconidia, 40 to 70 by 6 to 10 μ; 602, similar to 594; and 604, which secretes a water-soluble pink pigment diffusing into the medium and absorbing a part of the radiation. The data for 50 per cent. inactivation of the four aberrant strains showed wider variations than those recorded for 598, the response of which was comparatively uniform.

In a concluding discussion it is pointed out that the wave-lengths comprised within the toxic range are those most highly absorbed by nucleic acids rather than by proteins.

MOORE (M.). **The chorio-allantoic membrane of the developing chick as a medium for the cultivation and histo-pathologic study of pathogenic fungi.**—*Science*, N.S., lxxxix, 2318, p. 514, 1939.

Investigations by the author have shown that the chorio-allantoic membrane of the developing chick can be successfully utilized for inoculations with fungi pathogenic to man. The method is much less expensive than any entailing the use of laboratory animals and reduces the time required for the experiments to a matter of days.

WICKERHAM (L. J.) & RETTGER (L. F.). **A taxonomic study of Monilia albicans with special emphasis on morphology and morphological variation.**—*J. trop. Med.* (*Hyg.*), xlii, 12, pp. 174–177; 13, pp. 187–192; 14, pp. 204–216, 30 figs., 1939.

This is a detailed account of the authors' morphological and taxonomic studies at Yale University on *Monilia* [*Candida*] *albicans* [*R.A.M.*, xviii, p. 592], 39 strains of which were isolated from the human vagina, four from faeces, while of those received from other workers seven originated in the sputa of tuberculous patients and ten in lesions on poultry.

It was found that consistent fermentation reactions are obtainable when optimum quantities of carbohydrates, nitrogenous material, and molecular oxygen are supplied, the best results being given by filling the tubes to a depth of 8 cm. with a medium containing 2 per cent. carbohydrate, 0·3 per cent. each of yeast extract and peptone, and bromthymol blue. All the strains were found to possess certain common characteristics, while some showed features peculiar to themselves. Environmental factors played an important part in the morphological development of the different strains. These observations suggest that the classification of *Monilia* should be based on a broad conception of morphological characters rather than on slight and variable details. For instance, *M. albicans* should be regarded as comprising all strains that form hyphae giving rise to clusters of blastospores and (or) terminal chlamydospores, and inducing typical fermentation reactions in dextrose, maltose, sucrose, and lactose, the latter criterion being particularly valuable in clinical diagnosis. The strains under investigation were arbitrarily divided into five overlapping morphological types, according to the relative numbers of chlamydo- and blastospores produced on maize meal agar, and the reactions of ten representative members to variations in oxygen tension, age, medium, and temperature ascertained.

The authors, in common with most American workers, advocate the retention of the name *Monilia* (though admitting the botanical superiority of *Candida*) pending a general agreement among mycologists on the classification of the genus.

JOULIA (P.) & LE COULANT (P.). **Les épidermomycoses généralisées de la seconde enfance par champignons levuriformes.** [Generalized epidermomycoses of the second period of childhood due to levuriform fungi.]—*Ann. Derm. Syph., Paris*, Sér. 7, x, pp. 545–570, 9 figs., 1939.

This is a very detailed account of the clinical features of two cases of generalized epidermomycosis in children, one (acute) in a ten-year-old girl, and the other (chronic and ultimately fatal) in a boy aged eight at the onset of the disease, the course of which was followed for six years. Mycological studies (made in the second case only) revealed *Monilia* [*Candida*] *albicans* [see preceding abstract] as the agent of the disease.

GODFREY (G. H.) & RICH (H.). **Pasmo disease of Flax in the Lower Rio Grande Valley of Texas.**—*Plant Dis. Reptr*, xxiii, 11, pp. 194–195, 1939. [Mimeographed.]

Notes are given on the varietal reaction of flax in an experimental planting in the Lower Rio Grande Valley, Texas, to *Phlyctaena linicola* (*Sphaerella linorum*) [*R.A.M.*, xviii, p. 595]. Punjab was the most susceptible on a stem lesion basis, with a rating of 2·48 (5 being the maximum for very severe infection), roughly corresponding to a low-medium intensity involving perhaps 25 per cent. loss of stand, and Bolley Golden the most resistant (0·00), with no stem lesions (but considerable foliar invasion). The ratings for Buda, Rio (treated seed), N[orth] D[akota] 114, Bison, Rio (untreated), Argentine, Abyssinian Yellow, Linota, Redwing, and Giza were 0·08, 0·20, 0·98, 1·06, 1·34, 1·36, 1·44, 1·53, 2·28, and 2·31, respectively.

CALVINO (EVA M.). **Malattie rare o poco note segnalate nell' anno 1938.** [Rare or little-known diseases recorded in the year 1938.]—*Riv. Pat. veg.*, xxix, 5–6, pp. 261–271, 4 figs., 1939.

Of the four plant diseases recorded in this paper from the vicinity of San Remo the following may be mentioned. *Iris germanica* plants of four varieties imported from England, growing near Cap Martin, very close to the sea, developed dirty white flowers and also showed abnormal leaf and flower characters [unspecified]. When rhizomes from affected plants were grown in pots, development was poor, the leaves were pale and showed light green and yellowish stripes and spots, and the flowers had white petals with pale violet stripes. Light violet mottling was noted on the midrib of the stigmas, and violet spots and mottling were present on the floral bracts. The condition is diagnosed as mosaic [*R.A.M.*, xvi, p. 728], and is apparently closely analogous with 'complete break' of tulips [ibid., xviii, pp. 318, 528, 726].

Pelargonium zonale plants of the variety Millionaire growing outdoors were affected by a form of leaf curl [cf. ibid., xvii, p. 797] closely resembling Pape's virus-caused 'kräuselkrankheit' [ibid., vi, p. 728]. Small, yellowish-white spots developed on the under surface of the

leaves, became confluent, then appeared on the upper surface, and became brown and dry. The leaves became misshapen, twisted, perforated, and lacerated. On a few old plants the leaves appearing on new branches were all malformed.

Pestalozzia palmarum [ibid., xvi, p. 670] caused a leaf spot of *Phoenix canariensis*.

ARK (P. A.) & TOMPKINS (C. M.). **Bacteriosis of tuberous Begonia.**—*Phytopathology*, xxix, 7, pp. 633–637, 2 figs., 1939.

For several years past tuberous begonia (*Begonia tuberhybrida*) plants in nurseries in California have been affected by a leaf spot apparently favoured by high atmospheric humidity, relatively high temperatures, and close contact between the plants. Small, circular, blister-like spots, later becoming very conspicuous and transparent when examined by transmitted light, appear on the leaves, enlarge, and coalesce into large, water-soaked, necrotic areas sometimes (on dry specimens) exuding a yellow, dry ooze. Premature abscission of the leaf occurs.

Invasion of the vascular system was noted only in the greenhouse after spraying the plants in a moist chamber with a heavy water suspension of the organism isolated from affected material. After 8 to 12 days the plants were transferred to a warm greenhouse, when they developed a water-soaked appearance of the petioles, which spread into the main stem, with gradual softening of all tissues, and led finally to the entire collapse of the plants. Abundant bacteria were observed in the vascular elements and in all cases the organism isolated was identical with that sprayed on the plants, and was found by inoculation to be pathogenic to tuberous begonia leaves.

Further inoculation tests showed that *B. gracilis luminosa* and *B. lloydii* were also highly susceptible. Among the fibrous-rooted types (*B. semperflorens*) infection was obtained on Christmas Cheer, Fire Dwarf, Prima Donna, Rosabelle, Salmon Queen, and Vernon, as well as on the species *B. erfordii*, *B. haageana*, and *B. schmidtiana* var. *rosae*. Infection of the same species and varieties also resulted from spraying with a culture of *Phytomonas* [*Bacterium*] *flavozonatum* [*R.A.M.*, xvii, p. 749].

A comparative study of six different isolates of the leaf spot organism from different parts of California and *Bact. flavozonatum* showed no fundamental difference in morphological or cultural characters. The authors' organism also agreed completely with the description of *Phytomonas* [*Pseudomonas*] *begoniae* [loc. cit.]. It is accordingly suggested that the name *Phytomonas* [*Pseudomonas*] *begoniae* be retained for the organism, with *Bact. flavozonatum* as a synonym [ibid., xvii, p. 602].

ARONESCU-SĂVULESCU (ALICE). **Contribuțiuni la studiul ruginii de pe Gura Leului (Puccinia antirrhini Diet. et Holway).** [Contributions to the study of Snapdragon rust (*Puccinia antirrhini* Diet. & Holway).]—*Anal. Inst. Cerc. agron. Român.*, x (*1938*), pp. 473–517, 14 figs., 3 graphs, 1939. [Rumanian, with French translation.]

Severe attacks of snapdragon (*Antirrhinum majus*) rust [*Puccinia antirrhini*: *R.A.M.*, xviii, p. 457; xvii, p. 655] have occurred in Rumania

during 1937 and 1938, the period of infection lasting till late in November in spite of slight frosts. In the laboratory the uredospores of the fungus germinated best at temperatures between 7° and 18° C., the lower and upper temperature limits being 0° and 28°; under natural conditions the uredospores were found to withstand a temperature of $-6\cdot7°$ and show 40 to 50 per cent. germination in the following spring. Infection took place within a wide temperature range, succeeding at 20° but not at 5°. On agar the uredospores germinated at P_H values between 3·6 and 12·4, with an optimum at 6·4 to 8·6. Of the fungicides tested, sulphur dusts gave the best results.

McWhorter (F. P.). **Botrytis blight of Antirrhinum related to trichome disposition.**—*Phytopathology*, xxix, 7, pp. 651–652, 1 fig., 1939.

About 25 per cent. of a number of After Glow and Cheviot Maid Supreme *Antirrhinum majus* plants in a greenhouse in Oregon broke off at about 2 ft. from the ground in November, 1938, as a result of infection by a *Botrytis* of a cinereal form of the type producing long, dark brown conidiophores. The outbreak occurred shortly after the plants had been sprayed with an insecticide. Examination of several hundred plants showed that the foci of primary infections corresponded with the areas where the surfaces of the stems changed from glabrous to hirsute. The glandular trichomes in the affected stem areas were full of *Botrytis* mycelium, and infection was observed to take place through the trichomes.

Pasinetti (L.). **'L'Aecidium haussknechtianum' P. Henn su 'Berberis vulgaris' L. osservato per la prima volta in Italia.** [*Aecidium haussknechtianum* P. Henn. on *Berberis vulgaris* L., observed for the first time in Italy.]—*Riv. Pat. veg.*, xxix, 5–6, pp. 273–280, 4 figs., 1939.

The author gives a full description of *Aecidium haussknechtianum* which he observed in 1934 heavily infecting barberry in Lombardy, a new record for Italy.

Orsini (G.). **Intorno a una malattia dell' Aucuba japonica. (Prima nota).** [On a disease of *Aucuba japonica.* (First note).]—*Riv. Pat. veg.*, xxix, 5–6, pp. 249–259, 8 figs., 1939.

In April, 1937, *Aucuba japonica* plants in a garden at Todi, Italy, developed a brown discoloration of the leaves, which showed slight rolling and the margins of which were undulating. The healthy tissues were sharply defined from the necrotic parts, which readily fell away. Infection usually began at the leaf apex, spread slowly over the whole surface, reached the leaf stalk, which turned light brown, and, after rains, produced on the shoot a brown lesion which spread in a circular fashion and also longitudinally up to about half the internodes. The part of the shoot near the round lesion died, and the tissues invaded by the mycelium withered completely. The disease was present during the whole year, but became arrested during summer. The upper surface of the discoloured parts of the leaves bore perithecia of a species of *Pleospora* distinct from *P. infectoria* var. *aucubicola*. Cultures originating from ascospores gave rise to a species of *Macrosporium* and the latter was

also produced on perithecia on diseased leaves placed in a moist chamber. Furthermore the *Macrosporium* produced the *Pleospora* stage in culture [cf. *P. herbarum* and *Stemphylium botryosum*: *R.A.M.*, xviii, p. 141]. Inoculations with the *Macrosporium* gave positive results. Further investigations are in progress.

WEISS (F.). **Flower-spot of Azaleas: directions given for identification and control.**—*Sth. Flor.*, xlvi, 22, pp. 5, 12–13, 16–17, 1939. [Abs. in *Exp. Sta. Rec.*, lxxxi, 2, pp. 232–233, 1939.]

This is a preliminary report on a recently recognized azalea disease caused by *Ovulinia azaleae* [abs. in *Phytopath.*, xxviii, p. 21, 1938] and occurring throughout the south-eastern and Gulf Coast States from North Carolina to Louisiana, other susceptible hosts including mountain laurel [*Kalmia latifolia*] and certain species of *Vaccinium*. Promising results in the control of the disease have been obtained by applications at three-day intervals, from the incipient coloration of the buds to the full opening of the flowers (coinciding with the ascospore discharge period), of copper sprays or dusts or a dilute acetic acid solution.

TASUGI (H.) & IKEDA (Y.). **Phytophthora blight of Hibiscus manihot.**—*Ann. phytopath. Soc. Japan*, ix, 2, pp. 69–85, 9 figs., 3 graphs, 1939. [Japanese, with English summary.]

Hibiscus manihot at In'nosima, Hirosima Prefecture, Japan, has for several years shown a blight of the leaves, stems, and roots caused by *Phytophthora parasitica*. Inoculation experiments with the fungus were successful on the original host and also on tomato, potato, cotton, eggplant, broad bean [*Vicia faba*], and red pepper [*Capsicum annuum*], but not on tobacco.

NIJDAM (F. E.). **Over het voorkomen van Botrytis anthophila (Bond.) bij inlandsche Roode Klaver.** [On the occurrence of *Botrytis anthophila* (Bond.) in home-grown Red Clover.]—*Tijdschr. PlZiekt.*, xlv, 3, pp. 121–124, 2 figs., 1939.

Following a brief résumé of previous work on the anther mould of clover (*Botrytis anthophila*) [*R.A.M.*, xviii, p. 115], the writer records the occurrence of the disease on the Roosendaal red [*Trifolium pratense*] variety in Holland in 1933, when two out of six plants destined for hybridization were found to be infected. Inoculation experiments gave a very low percentage of successful results (2 out of a total of 66 plants), but it has been observed that the disease may remain latent for two generations in the progeny of a cross involving one infected and one healthy parent, to reappear in the F_3. In such cases the number of spores in the apparently sound pollen is presumably so minute as to escape detection altogether.

ALLISON (J. L.). **Studies of monosporous cultures of Septoria bromigena.**—*Phytopathology*, xxix, 6, pp. 554–556, 1 fig., 1939.

On twelve artificial media, of which potato dextrose agar proved to be the most suitable for further studies, 200 monospore lines of *Septoria bromigena*, isolated from *Bromus inermis* in 1937, fell into four cultural groups according to the localities in Minnesota whence they originated.

Thus, the isolates from University Farm produced short, pink aerial hyphae with an outer zone of dark, leathery mycelium; those from Coon Creek formed a tough, leathery mycelial mat with very short, dark grey to brick-red hyphae; the Dundas strains were characterized by dark hyphae over a rough mycelial mat; and those from Waseca by white and dark hyphae over a solid, leathery mycelial mat. All the isolates normally gave rise to an abundance of pycnidia, but in some cultures variants arose producing few or none. In greenhouse inoculation tests the parent cultures were severely pathogenic to *B. inermis*, but the non-sporulating mutants caused no infection.

WALLACE (T.). **Magnesium-deficiency in fruit trees.**—*J. Pomol.*, xvii, 2, pp. 150–166, 1939.

Magnesium deficiency is stated to occur in a variety of crop plants in the eastern United States, Germany, Holland, Belgium, Czechoslovakia, New South Wales, and Canada on light, sandy soils, usually strongly acid in reaction and subject to excessive leaching by rain. The affected plants are characterized by chlorosis of the leaf tips and edges, later spreading towards the midrib, necrosis of interveinal tissue, and premature fall of the older leaves which are always the first affected. The chlorotic parts later become necrotic brown, and brittle. Instead of chlorotic symptoms affected parts may turn pale green in well-defined areas and then suddenly become brown and dry out as in apples, or develop well-marked patterns, usually in red, on the upper leaf surface as in the black currant. The leaves are very thin, with a prematurely formed abciss layer, which may be the cause of abnormal susceptibility to spray injury.

Data are presented on magnesium deficiency observed in apple trees grown on three different sites in England, sites I and II having strongly acid, leached soils deficient in lime and magnesium and site III deficient in magnesia only, the symptoms comprising the typical blotching on the first two sites but being somewhat less characteristic on the third site. With regard to control, the use of magnesian limestone (500 to 1,000 lb. per acre) has been found effective for annual plants on acid soils but may be slow in action for fruit trees. The quick-acting Epsom salts, kieserite, and sulphate of potash-magnesia do not contain calcium and should, therefore, be used, at a rate of approximately 1 cwt. per acre, on acid soils only in conjunction with calcium, while on neutral soils, in which the calcium status is satisfactory or high, they can be used in preference to others.

WILKINSON (E. H.). **A note on the prevalence of fungal spots and rots of Apples in cold store at Long Ashton.**—*Rep. agric. hort. Res. Sta. Bristol, 1938*, pp. 84–90, [1939].

Notes are given on the species of fungi causing rotting of apples (from trees grown under various treatments in different parts of England) placed in cold storage at Long Ashton. The fungus causing the most severe rotting and spotting was *Gloeosporium album* [*R.A.M.*, xviii, p. 533], followed in order by *Botrytis cinerea, Penicillium expansum, Sclerotinia fructigena* [ibid., xvii, p. 13], *Nectria galligena* [ibid., xvi, p. 323], *Alternaria* sp., *Rhizopus nigricans* [ibid., xv, p. 555], *G.*

fructigenum [*Glomerella cingulata*: ibid., xvii, pp. 465, 536], *Cephalothecium* [*Trichothecium*] *roseum* [ibid., xvi, p. 756], *Diaporthe* spp., and miscellaneous fungi (*Sphaeropsis malorum* [*Physalospora obtusa*: ibid., xvii, p. 69], *Pleospora pomorum* [ibid., xv, p. 424], and *Fusarium* sp.).

G. album effects entry through the lenticels, each lesion having a lenticel at the centre. All the samples stored in 1937 became infected by this fungus, which alone was responsible for 47 per cent. infection out of a total amount of 54 per cent. Worcester Pearmain apples from near Ross-on-Wye given low and high nitrogen treatment showed 10 and 31 per cent. infection by *G. album*, respectively. Cox's Orange Pippin from Chelmsford had 41 per cent. infection, while the varieties Bramley, Grenadier, and Derby appeared to be more resistant.

B. cinerea also caused much rotting among fruits showing stalk-end russeting, especially in the varieties Cox's Orange Pippin and Laxton's Superb. *P. expansum* usually played a minor part in the rotting of stored apples but caused severe damage as a secondary invader round scab [*Venturia inaequalis*] lesions in Worcester Pearmains from one locality. Rotting due to *S. fructigena* was most frequent in Bramley Seedling apples from East Malling (3 per cent.).

Pugsley (A. T.). **Silver leaf disease of fruit trees. Control measures recommended.**—*J. Dep. Agric. Vict.*, xxxvii, 5, pp. 220–221, 2 figs., 1939.

A popular account is given of the silver leaf disease (*Stereum purpureum*) [*R.A.M.*, xvi, p. 690] which has been recorded from widely separated districts in Victoria on apples, plums, and apricots, but in a few instances only does it appear to have established itself.

Fish (S.). **Summer spot of Pears.**—*Fruit World, Melbourne*, xl, 5, p. 7, 1939.

The continued development of pear black spot [scab] (*Venturia pirina*) during the summer in Victoria [*R.A.M.*, xvi, p. 187] is stated in some seasons to have rendered 25 per cent. of the crop unfit for export. During three years' tests, summer spot was consistently controlled by two pre-blossom applications of Bordeaux mixture (6–4–40), followed by a cover spray of Bordeaux mixture (3–3–50) three weeks after the fruit had formed. Maximum protection consistent with freedom from spray injury resulted when the first pre-blossom application was made at the late green tip stage, and the second at the green flower-bud stage. The treatment caused some russeting on sensitive green pear varieties, such as Packham's Triumph, but was quite satisfactory on less sensitive green varieties (such as William's B[on] C[hrétien]), brown varieties, Beurré Bosc, and Winter Nelis. Trials to find a substitute for the Bordeaux 3–3–50 spray, which is responsible for the russeting, were unsuccessful.

Smith (C. O.) & Cochran (L. C.). **Rust on the California native Pruni.**—*Phytopathology*, xxix, 7, pp. 645–646, 1 fig., 1939.

In a mixed planting at Riverside, California, of the native species *Prunus andersonii*, *P. demissa*, *P. emarginata*, *P. fasciculata*, *P. fre-*

montii, *P. ilicifolia*, *P. ilicifolia* var. *integrifolia*, and *P. subcordata* cultivated with other species of *Prunus* and *Amygdalus*, rust (*Tranzschelia* [*Puccinia*] *pruni-spinosae*) [*R.A.M.*, xvii, p. 756; xviii, p. 322] was often noted on the susceptible horticultural varieties of apricot, plum, and peach, and all the indigenous species listed were susceptible except *P. demissa* and *P. ilicifolia*. *P. emarginata* became infected after artificial inoculation in the open with spores taken from almond. Teleutospores of the *discolor* type were observed on *P. fasciculata*. The *typica* type of rust was not seen.

BLODGETT (E. C.) & COLWELL (W. E.). **Relation of drought spot of Prunes to boron content of fruit.**—*Phytopathology*, xxix, 7, pp. 650–651, 1939.

All four well-known types of drought injury on plum fruits [*R.A.M.*, xvi, p. 687] have been found in Idaho orchards, viz., gum spots (gum pocket disease), with crescent-shaped superficial scars; shrivelling for a fourth to a third of the length, with browning and blackening of the underlying flesh; shrivelling of the cheek, with brown lines of injured tissue extending through the flesh; and browning of the cells lining the pit cavity. Observations have shown that plums affected by gum (or drought) spot are very firm in flesh and of poor quality, and do not improve in storage. The firmness is largely due to dead, corky areas, and a pronounced sticking to the pit. Internal discoloration is common, especially near the pit. The condition constitutes a serious and neglected problem, especially in the dried fruits. It is most severe in years when irrigation is inadequate, especially on light, porous soils.

Preliminary data show a definite relation between the condition and a low boron content of the fruit tissues and pits. The condition is noticeably severe in one area where the soil is deficient in boron.

CHRISTOFF (A.). **Experiments and notes on the virus diseases of fruit trees in Bulgaria.**—*Bull. Soc. bot. Bulgarie*, viii, pp. 55–64, 1939.

These notes on various virus diseases of fruit trees in Bulgaria [cf. *R.A.M.*, xviii, p. 188] contain the following interesting observations. While during 1937 the symptoms of broad streak and narrow-striped variegation on plum and greengage trees [loc. cit.] were visible during the whole season, in the following year they were present only in early spring, and not only failed to appear on the new leaves but became masked on old ones. No explanation has yet been found for this phenomenon. The separation of these two diseases was successfully made on plum: three virus-free plum trees of the Kustendil variety budded with buds from a plum infected with broad streak developed symptoms of broad streak in the following season, while typical narrow-striped variegation appeared on three similar plum trees budded with buds from a plum infected with narrow-striped variegation. The latter disease was successfully transmitted by budding from plum to peach, after an incubation period of two years; greengage trees budded with buds from an apparently healthy Japanese plum (*Prunus salicina*) developed narrow-stripe symptoms in the following season, while the Japanese plum showed them only two years after budding. The double infection of a greengage tree with buds from a Kustendil plum having

narrow-striped variegation and from a Green Queen Claudia plum infected with mosaic produced the symptoms of both diseases, either simultaneously or first the one and then the other. When a row of greengage trees, either healthy or infected with star-like mosaic [loc. cit.], were budded with one and the same peach variety, all infected greengage stocks produced peach shoots with symptoms of chlorosis, substantiating the author's suggestion that star-like mosaic can be one of the causes of chlorosis of the peach.

Pear trees of the varieties Cure, Diel's Butterbirne, and Eniseika, which had shown symptoms of mosaic from 1935 to 1937, were free from them in 1938, possibly owing to excessive heat and long drought of this year. Buds from mosaic-diseased Cure scions, heated for $10\frac{1}{2}$ to 11 minutes at temperatures of 40° to 60° C., successfully transmitted the disease to wild pear trees.

Evidence is adduced that chlorosis of apple and pear may result from infection by the mosaic virus which, it is thought, renders the trees sensitive to unfavourable soil and other conditions.

BROWN (H. P.). **Gummosis and die-back of Cherry trees. A bacterial disease.**—*Agric. Gaz. N.S.W.*, 1, 7, pp. 386–388, 4 figs., 1939.

During the last few years, growers in New South Wales have found difficulty in the establishment of new blocks of cherry trees. Between planting and the early years of commercial cropping heavy losses have resulted from the death of 'leaders', and, in some instances, the young trees have died off. Many trees of most varieties show cankered or discoloured areas of bark copiously exuding gum. The evidence obtained showed that the disease was associated with an organism (the parasitic nature of which was demonstrated) identified on a basis of laboratory tests with *Pseudomonas mors-prunorum* [*R.A.M.*, xviii, p. 689]. A species of *Cytospora* and one of *Cylindrosporium* were frequently found fructifying on affected wood, but are considered to be secondary.

Inoculation tests under field conditions broadly confirmed the results of English workers. Attempts to isolate the organism from wood cankers during the warmer months were unsuccessful.

Control measures tentatively suggested are as follows. Pruning and other operations involving tree injuries should be effected in summer, soon after harvest, as wounds appear to afford an important means of entry. The trees should be well sprayed with Bordeaux mixture (3–2–40) early in the autumn and given a further application at double strength between late autumn and midwinter, using a spreader on both occasions.

WALLACE (T.). **Summary of results of manurial experiments on Black Currants, Raspberries, and Strawberries at Long Ashton, 1924–1937.**—*Rep. agric. hort. Res. Sta. Bristol, 1938*, pp. 17–39, [1939].

In the manurial experiments summarized in this paper it was found that potash deficiency induced decreased susceptibility in black currants to *Pseudopeziza ribis*, while nitrogen and phosphate deficiencies appeared to increase susceptibility. Farmyard manure appeared to reduce susceptibility.

Schwartze (C. D.) & Huber (G. A.). **Further data on breeding mosaic-escaping Raspberries.**—*Phytopathology*, xxix, 7, pp. 647–648, 1939.

In small populations, produced by inbreeding the Lloyd George red raspberry variety (resistant to the mosaic vector *Amphorophora rubi* but heterozygous for resistance) [*R.A.M.*, xviii, p. 190] and crossing it with susceptible varieties, a few seedlings were resistant, and several varieties and seedlings somewhat resistant. Other data indicated that susceptible varieties may be homozygous.

Further evidence showed that relatively high percentages of seedlings resistant to *A. rubi* can be produced by crossing heterozygous parents, and strongly indicated that Lloyd George carried two or more factors for resistance, and that resistance is dominant to susceptibility. WSC22 (Lloyd George selfed, somewhat resistant) × Lloyd George gave a higher percentage of resistant hybrids than did crosses between Lloyd George and resistant parents. The somewhat resistant type would appear to carry at least one genetic factor for resistance.

There are now present in the breeding plots in Washington 111 hybrids, inbred seedlings, and named varieties on which *A. rubi* does not feed, and, owing to their parentage, most of these must be heterozygous for resistance. Further work in progress should give homozygous resistant individuals transmitting resistance to all their offspring when crossed with susceptible varieties.

Hildebrand (A. A.). **Notes on mealy bug injury on Strawberry and its resemblance to crinkle.**—*Canad. J. Res.*, Sect. C., xvii, 7, pp. 205–211, 6 figs., 1939.

Symptoms observed for several years on strawberry plants grown in the greenhouse in Canada and previously attributed to crinkle [*R.A.M.*, xviii, p. 604] were experimentally shown during 1938 to be primarily caused by mealy bugs, *Pseudococcus* spp., all 20 plants to which the insects had been transferred developing the condition. The points of similarity between the two troubles lie in the occurrence of translucent or chlorotic spots on young leaves with minute, more intensely chlorotic spots in the centres, in the uneven chlorosis and malformation of the older leaves, shortening of the petioles, and general dwarfing of heavily infested plants. The crinkled or rugose condition of the foliage remains a diagnostic symptom of crinkle, which is also often associated with clearing of the veins, a feature not observed in mealy bug injury.

Wardlaw (C. W.), Leonard (E. R.), & Barnell (H. R.). **Banana storage investigations, 1937–39.**—*Trop. Agriculture, Trin.*, xvi, 6, pp. 130–142, 2 pl., 1939.

In further investigations in Trinidad into the storage behaviour of Gros Michel bananas [*R.A.M.*, xiii, p. 252] the fruit was held at tropical temperatures for 24 to 36 hours, stored at 53° F. for 15 days, and finally ripened at 68°. It was found that the 'standard $\frac{3}{4}$-full' (English grade) bunches behaved normally, but that heavier bunches could not be kept in the green, unripe condition for more than 10 to 12 days at 53°. The onset of ripening at this temperature is shown by the development of a yellow colour, which becomes modified by sooty or bronze colours indicating low temperature injury. When placed at 68°, the heavier

grades showed rapid development of ripening and chilling colour, but later on the chilling colours were sometimes masked by a strong development of normal pigment. Chilling injury was much less marked in bunches ripened at 80 to 90 per cent. relative humidity than in those ripened at one of 70 per cent. Individual 'heavy $\frac{3}{4}$-full' and 'full' fingers (American grades) stored at 53° for 22 days and then transferred to 68° developed conspicuous chilling colours by the 22nd day, and later became tough and leathery.

Observations on fruits from plantations infected by *Cercospora musae* [ibid., xviii, p. 327], held at 53° for 15 days and then ripened at 68°, showed that affected fruit is characterized by buff-coloured pulp, ripens prematurely, chills during the period of refrigerated transport, and ripens too rapidly on removal to a higher temperature. The bunches remain small, and the fruit may be much more mature than its appearance suggests, with the result that it is likely to depart from the normal storage behaviour of its grade.

BRATLEY (C. O.) & MASON (A. S.). **Control of black rot of Pineapples in transit.**—*Circ. U.S. Dep. Agric.* 511, 12 pp., 1 fig., 1939.

Fourteen holding experiments in Puerto Rico and seven shipping experiments between Puerto Rico and New York with various materials for the control of black rot (*Thielaviopsis* [*Ceratostomella*] *paradoxa*) [*R.A.M.*, xvii, pp. 51, 761] of Red Spanish pineapples showed that the best results were given by a solution of $2\frac{1}{2}$ gm. benzoic acid [ibid., xi, p. 192] in 100 c.c. of 30 per cent. alcohol applied to the cut stalk of the inoculated fruits with a small paint brush. The effectiveness of the treatment decreased as the period between inoculation and treatment increased. Treatment was most effective on fruits of 'mature green maturity'. Observations showed that much of the rot begins at packing bruises. For practical purposes 95 per cent. alcohol is denatured by the addition of $10\frac{1}{2}$ oz. benzoic acid per gal. and the solution diluted with 3·2 times its volume of water. The pineapple after removal from the plant is carried to the end of the row, its base exposed to the sun's rays for two to four hours, and the solution applied by means of a brush. A man can treat from 8,000 to 12,000 fruits in an eight-hour day, and the cost for labour and material amounted to about half a cent per box of fruit. No injury to the fruit was observed.

NOBLE (R. J.) & NOBLE (N. S.). **Aphid vectors of the virus of woodiness or bullet disease in Passion Fruit (Passiflora edulis Tims).**—*J. roy. Soc. N.S.W.*, lxxii, pp. 293–317, 2 pl., 1 fig., 1939.

Owing chiefly to the widespread incidence of woodiness disease of passion fruit (*Passiflora edulis*) in New South Wales [*R.A.M.*, viii, p. 185; xvii, p. 730] the total yield was reduced from 73,230 bush. in 1928 to 31,550 bush. in 1937, the average yield per vine declining from 0·43 to 0·18 bush.

Of all the diseases affecting this host locally woodiness is the most serious. Fruits on infected vines are sometimes stippled or blotched and may show small ring-like markings. In mild weather the terminal leaves are conspicuously curled down along the axis of the main veins. The upper surfaces of the leaf tips may press against the under surface of

the petioles or main veins, the laminae showing a cylindrical curling. Marked vein clearing occurs in these young leaves. Curling is most evident when the growth occurs at temperatures below 80° F., but puckering and mottling are the first symptoms at higher temperatures. After the development of leaf curl, and while the temperature is not over 80°, the upper leaves tend to become chlorotic, and subsequently drop. The disease temporarily checks growth, and infected plants are shorter than normal ones. Artificial inoculations gave positive results most readily in vigorously growing plants exposed to relatively high humidities and temperatures not exceeding 75°. Masking occurred at temperatures over 85°, the symptoms reappearing in the new growth at lower temperatures. Leaf malformation occasionally took the form of reduced development of the lamina, such leaves being longer and narrower than normal juvenile leaves, or sometimes showing a fern leaf appearance. No evidence was obtained of seed transmission.

In experiments on insect transmission large numbers of a dark aphid, referred to as *Aphis* sp. A, obtained from *Stizolobium* sp. were fed for five or six days on a mechanically infected passion vine, after which they were transferred to six healthy passion vines (three for each feeding period), all of which showed leaf curl symptoms in six to nine days. In a second test one out of six test plants on which infective aphids were placed developed leaf curl. In the third experiment the aphids were transferred from *Stizolobium* to healthy pre-feeder passion vines, and then part of the population to healthy passion fruit plants and another part to infected passion fruit plants, after which populations from the healthy and diseased feeder plants were transferred to healthy test plants. Six of the ten plants in the infective vector series became affected while the pre-feeder and control plants remained healthy. Transmission was also secured in outdoor experiments.

In similar tests with a dark aphid from *Cotyledon valida*, referred to as *Aphis* sp. B, (not using healthy pre-feeder plants) symptoms were secured (when the populations had been rendered infective by feeding on infected vines) six to eleven days after transfer to the healthy plants. Tests with single aphids gave typical symptoms on 2 of 24 plants.

When populations of *Myzus persicae* from sprouting potatoes were transferred to healthy passion vines after feeding for one to three days on mechanically infected vines, positive results were obtained in 7 to 11 days. Further evidence showed that symptoms arose only from vectors that became infective after feeding on diseased vines. With single aphids the virus was transferred to 3 of 25 plants.

In tests with *Macrosiphum solanifolii* aphid populations transferred from diseased to healthy vines gave leaf curl symptoms on two out of four plants. When bulk populations, healthy pre-feeder, and healthy and diseased feeder plants were used three of the five test plants in the infective vector series developed the leaf curl symptom. In an outdoor test, first symptoms were observed ten days after transfer of presumably infective aphids to the test plants.

Insects other than aphids were not found capable of transmission. Under field conditions it is possible that in New South Wales *Myzus persicae* is the chief vector.

Some growers have obtained satisfactory control by improved

sanitary measures, including planting only healthy seedlings, removing affected young plants, and completely eradicating diseased plantations before replanting. As the vines are visited by aphids only at infrequent intervals, the adoption of aphicidal measures at appropriate periods may prove economically feasible and of value in control.

[A short account of this work appears in *Agric. Gaz., N.S.W.*, l, 1, pp. 19–21, 1939.]

SATTAR (A.) & MALIK (S. A.). **Some studies on anthracnose of Mango caused by Glomerella cingulata Stonem. (S. & v. S.) (Colletotrichum gloeosporioides Penz.) in the Punjab.**—*Indian J. agric. Sci.*, ix, 3, pp. 511–521, 2 pl. (1 col.), 2 graphs, 1939.

Anthracnose of mango, caused by *Colletotrichum gloeosporioides* (the conidial stage of *Glomerella cingulata*) [*R.A.M.*, xvii, p. 761], is reported from several districts in the Punjab, where the disease attacks the leaves, twigs, and fruits. On the leaves it forms numerous oval or irregular brown spots, sometimes extending to elongated necrotic areas. When the petioles are affected the leaves droop and ultimately fall. On the twigs black necrotic areas develop from the tips downwards causing a die-back. In a cultural study the fungus was found to grow best on most media at temperatures between 25° and 29° C. (the minimum temperature for growth being between 10° and 15° and the maximum between 35° and 40°); the optimum hydrogen-ion concentration was P_H 6·9, but fairly good growth was obtained from P_H 4 to 9. Inoculation experiments were successful on leaves, petioles, stems, and fruits, the optimum temperature for infection being 25°. Under experimental conditions in the open at Lyallpur, the disease perennated in the detached diseased twigs and leaves lying on the surface of the soil and in the diseased twigs attached to the trees. Trials conducted at Multan showed that the disease can be effectively controlled by destroying all potential sources of infection (namely, diseased leaves and twigs lying on the soil, and diseased prunings) and by spraying young grafted mango trees with 3–3–50 Bordeaux mixture in February, March, and September.

THOMAS (K. M.) & KRISHNASWAMI (C. S.). **Leaf crinkle—a transmissible disease of Papaya.**—*Curr. Sci.*, viii, 7, p. 316, 1 fig., 1939.

Papaw seedlings in a pot culture house at Coimbatore developed an apparently new disease, termed leaf crinkle [cf. *R.A.M.*, xviii, p. 693], characterized by slightly zigzag stems, crinkled leaves with the lobes curving downwards and inwards in the shape of an inverted cup, and with thick, gnarled, dark green, opaque veins on the under side. The affected seedlings did not develop dwarfing, and exhibited the symptoms throughout growth. When pollarded, they developed characteristically affected leaves. No organism appeared to be associated with the condition. When affected seedlings were grafted by inarching on to six healthy seedlings, three of the latter developed symptoms of the condition within 120 days.

BERRY (W. E.). **Spray injury studies. Progress Report I. Some observations on the probable causes of lime sulphur injury.**—*Rep. agric. hort. Res. Sta. Bristol, 1938*, pp. 124–144, [1939].

Lime-sulphur injury to apples is of two types. In the first type leaves

not fully opened may show scorching of the tips and margins, especially when frost follows the application of the spray. Fully opened leaves may develop a scorch in the form of necrotic patches generally adjoining the larger veins and occurring mainly when the spray fluid has accumulated on the leaf. In the second type, extensive defoliations may occur soon after the spray is applied without any other sign of injury. At Long Ashton the Worcester Pearmain, Laxton's Superb, Allington Pippin, and Rival varieties may be sprayed with 1½ per cent. lime-sulphur at any stage without injury, Cox's Orange Pippin, Bramley's Seedling, and Newton Wonder will stand a maximum of 1 per cent. while Lane's Prince Albert, Lord Derby, Stirling Castle, and St. Cecilia are extremely sensitive to sulphur. Tolerant and sensitive varieties are also found in currants, gooseberries, pears, and plums.

When Cox's Orange Pippin apple trees were sprayed in successive groups with 2 per cent. lime-sulphur at intervals from 7.30 a.m. to 10 p.m. on 13th June, 1938, the leaf fall caused by the spraying during the next five days was found to be correlated with the temperature, humidity, and sunshine prevailing at the time of the application. Maximum fall occurred as a result of the spray given at 5.30 p.m. when temperature was high, humidity low, and sunshine continuous. The data supported the view that spray injury is more prevalent in sunny than cloudy conditions, and temperature appeared to be a more important factor than humidity. Scorching, which was very slight, became apparent in 7 to 10 days.

To ascertain whether a spray deposit may exert sufficient desiccating effect to cause leaf injury, Cox's Orange Pippin and Lane's Prince Albert apple trees were sprayed with 0·5 M sucrose and 0·5 M calcium chloride solutions as desiccating sprays, and 2 per cent. lime-sulphur for purposes of comparison. The applications were made on 13th June, in the afternoon. By 18th June, the total leaf fall on Cox's Orange Pippin was 17·2, 17·2, and 74 leaves per tree for the treated trees, respectively, against 18 for the unsprayed control, and on Lane's Prince Albert 90·3, 93·6, and 186 for the treatments, respectively, no controls being available.

The evidence suggests that the susceptibility of the Lane's variety to spray damage may not be confined to sulphur sensitivity. It is concluded that the damaging effect of lime-sulphur is mainly due to a specific effect of sulphur compounds on the leaf, desiccation playing a comparatively minor part.

Laboratory investigation into the effect of lime-sulphur spray on detached Lane's Prince Albert and Laxton's Superb apple leaves showed that at first the respiration rate of the sprayed leaves was higher than that of the unsprayed, but later fell below it. Leaf injury due to lime-sulphur appears to result from the direct entry of spray fluid into the cells, through intact cuticle or lesions. The view is expressed that sulphur injury of the type resulting in leaf abscission may be due to a gaseous or volatile compound, probably hydrogen sulphide.

Höfer (H.). **Praxis und Theorie der Wirkung von Kupferspritzmitteln auf Pflanzen.** [The practice and theory of the action of copper sprays on plants.]—*Angew. Bot.*, xxi, 3, pp. 261–301, 17 figs., 1939.

Reckendorfer's investigations showed that a deposit of Bordeaux

mixture undergoes decomposition through the action of atmospheric humidity and carbon dioxide [*R.A.M.*, xvi, p. 110], and further that the deleterious action of the fungicide on the tissues of certain plants is primarily due to the copper sulphate component of the compound.

In the writer's experiments at the Dresden Technical College to determine the action of 2 per cent. Bordeaux mixture on leaves of different anatomical and physiological types, the presence of soft, long hairs, as in *Sorbus* [*Pyrus*] *hybrida* and *Viburnum lantana*, or of a wax layer (*Symphoricarpos racemosus*), prevents the adhesion to the epidermis of the solution and greatly reduces its efficacy. On the other hand, the stiff, vertical hairs of *Corylus avellana* and black currant (*Ribes nigrum*) constitute no impediment to the infiltration of the spray fluid, which forms a thin crust over the epidermis and is largely protected by the hair bases against washing off.

The well-known foliar injuries associated with Bordeaux treatments appear to be peculiar to highly cultivated fruit trees and bushes, since with the exception of mild symptoms on *Pelargonium zonale*, none of the 42 plants sprayed with the mixture at concentrations of 1 to 6 per cent. sustained any damage. The susceptibility of leaves to copper sulphate injury was found to depend to some extent on the structure of the epidermis, the best defence being provided by a thick cuticle or multilaminate epidermis, as for example in holly (*Ilex aquifolia*), ivy (*Hedera helix*), box (*Buxus sempervirens*), and *Vinca minor*, which sustained no damage from a fortnight's contact with a 7 per cent. solution. A wax coating, as in peas, broad beans (*Vicia faba*), *Allium fistulosum*, sea-kale (*Crambe maritima*), and nasturtium (*Tropaeolum majus*), failed to prevent injury, except at very low concentrations, but retarded its onset, while a similar action was exerted by water tissue (*Tradescantia fluminensis*, *Begonia* spp., *Peperomia arifolia*). Plants with glabrous or pubescent leaves, the former represented by beech (*Fagus orientalis*), *Magnolia speciosa*, gooseberry, and five other species, and the latter, e.g., by soy-bean, *Cucurbita maxima*, and *Pyrus eleagnifolia*, showed almost equal susceptibility to scorching. The individual tissues were found to differ in their reactions to the fungicide, the most sensitive (in the order given) being the lower and upper epidermis, collenchyma, sclerenchyma, vessels, sieve-tubes, spongy, cortical, and assimilatory parenchyma, and cambium [ibid., xv, p. 36]. The copper sulphate was shown by anatomical examination to exert an injurious stimulus, not confined to the immediately affected tissues, but involving the adjacent areas.

Not even by means of X-rays was it possible to detect the actual presence of copper in the damaged tissues, the observed detrimental effects on which are evidently produced by infinitesimal and imperceptible amounts of the mineral. In experiments on soy-beans, the absorption of lithium chloride by the leaves without damage was spectroscopically demonstrated, the under side of the leaf apparently being the chief site of entry, and it is considered probable that copper is similarly taken up. By means of adjustments of the prevailing humidity (soil and atmospheric), temperature, and atmospheric stillness or motion it was possible to induce rapid changes in the osmotic values of *C. maxima* and *Coleus*, pointing, according to Menzel [loc. cit.] to corre-

sponding modifications in susceptibility to copper injury, but experimental proof of this hypothesis is not yet forthcoming. The physiological condition of the sprayed plants would appear to be the governing factor in their reaction to contact with the copper salts, though naturally the individual anatomical features must also be studied in relation to the phenomenon under discussion.

Maier (W.). **Die durch Regen an blaugespritzten Obstbäumen gelösten Kupfermengen und ihre fungizide Wirksamkeit.** [The quantities of copper washed off 'blue'-sprayed fruit trees by rain and their fungicidal efficacy.]—*Angew. Bot.*, xxi, 3, pp. 302–307, 1 graph, 1939.

The result of the writer's experiments on the dissolution by rain of the copper on pear trees treated by the 'blue' method against *Venturia pirina* at the Geisenheim (Rhine) Research Institute, and the relation of this process to the efficacy of the treatment have already been described from another source [*R.A.M.*, xviii, p. 462].

Pryor (D. E.) & Walker (J. C.). **A method for testing the toxicity of volatile compounds.**—*Phytopathology*, xxix, 7, pp. 641–643, 1 fig., 1939.

An improved method for testing the toxicity of volatile compounds in the vapour phase is described in which a minimum of special glassware is required. The containers are Petri dishes sealed with parafilm or glass-top fruit jars. The fungus culture is placed on an agar film deposited upon the inside of the cover. The films must be uniform in diameter and thickness to avoid a differential in the rate of absorption of the volatile substance placed in the bottom of the container. The film, therefore, is made by pouring agar on to a specially constructed glass plate covered with a sheet of glass supported on pieces of glass within a transfer chamber, and from the film 2 in. disks are cut with a 'biscuit cutter' and transferred to the containers with a sterile spatula.

Wilcoxon (F.) & McCallan (S. E. A.). **Theoretical principles underlying laboratory toxicity tests of fungicides.**—*Contr. Boyce Thompson Inst.*, x, 3, pp. 329–338, 3 graphs, 1939.

Toxicity experiments are stated to be of two types, those in which some property of each individual such as germ-tube length or diameter of colonies, is measured quantitatively, and those in which the individuals are divided into two categories, such as germinated and non-germinated spores. Toxicity curves obtained by the second method result from the possession by each individual spore of its own particular lethal dose, there being a distribution of individual lethal doses which tends to be symmetrical when plotted against the logarithm of the concentration of the toxic agent. Two rapid, approximate methods of deducing the properties of the curve of individual lethal doses from the toxicity data obtained are described. One involves plotting the percentage of viable spores failing to germinate against the logarithm of the concentration, using semi-logarithmic paper if desired. The other involves the use of logarithmic probability paper, the percentages of spores failing to germinate being plotted on the vertical axis against the corresponding

concentrations on the horizontal axis; the best straight line is then drawn through the points giving the greatest weight to points in the neighbourhood of 50 per cent. From these graphs the LD 50 value, i.e., the concentration preventing 50 per cent. germination [*R.A.M.*, xvii, p. 540] may be estimated [by a method which is described], and the range within which it may be expected to lie 19 times out of 20. The methods may be extended to estimate LD 95 and its corresponding zone of error.

When it is necessary to compare fungicides run at different times or in different laboratories, they should be rated in terms of a standard fungicide run at the same time.

CHIARUGI (A.). **L'eredità in patologia vegetale.** [Heredity in plant pathology.]—*Relaz. IV. Congr. int. Pat. comp., 1939*, pp. 155–210, 1939. [German, English, Spanish, and French summaries.]

In this paper the author discusses in some detail the available information on hereditary factors causing disease in plants. These may have a direct or indirect function, the former resulting from a change in the genic balance which may be permanent or temporary, and the latter involving the segregation of specific genes determining resistance. The paper concludes with a discussion of the theory of genetic centres of cultivated plants.

NĚMEC (B.), PETRI (L.), & QUANJER [(H. M.)]. **Regressive changes in plants.**—*Relaz. IV Congr. int. Pat. comp., 1939*, pp. 443–515, 1939. [English, Spanish, French, and Italian summaries.]

The three authors make individual contributions to this symposium on regressive changes in plants resulting from natural or pathological causes. The field covered is wide and various theories are advanced to explain the observed changes in plant tissues and individual cells. Petri's contribution (pp. 459–507) concludes with a bibliography of approximately 250 titles.

AINSWORTH (G. C.). **Agreement to use the fungus binomials recommended in the List of Common Names of British Plant Diseases.**—*Trans. Brit. mycol. Soc.*, xxiii, 3, pp. 271–272, 1939.

In his capacity as Secretary of the Plant Pathology Committee of the British Mycological Society G. C. Ainsworth announces that 42 Offices, Societies, and Institutes in the United Kingdom have agreed to use the fungus binomials recommended in the 'List of common names of British plant diseases' [*R.A.M.*, xiv, p. 325; xv, p. 467] in their official publications. Arrangements have been made to have the List revised more frequently, and for any necessary emendations to be published in the *Trans. Brit. mycol. Soc.* or in new editions. Every effort has been made to ensure that the fungus names included in the List conform to the International Rules of Botanical Nomenclature and it is hoped, therefore, that the binomials recommended may constitute, within the British Isles, a standard list of names of the more important fungus parasites.

WAKEFIELD (E[LSIE] M.). **Nomina generica conservanda. Contributions from the Nomenclature Committee of the British Mycological Society. I.**—*Trans. Brit. mycol. Soc.*, xxiii, 2, pp. 215–232, 1939.

The preparation and publication by the Plant Pathology Committee of the British Mycological Society of the 'List of common names of British plant diseases' convinced the Committee of the urgent need for international agreement about the conservation of generic names which are in common use but are not in accordance with the International Rules of Botanical Nomenclature. For this reason the Council of the British Mycological Society appointed a Committee, under the chairmanship of E. W. Mason and with Miss E. M. Wakefield as secretary, for the investigation of problems of nomenclature with a view to making some proposals before the next International Botanical Congress, which is expected to meet at Stockholm in 1940. In order to co-ordinate the material which is prerequisite for solving the most urgent problems of nomenclature, this Committee has prepared statements of the cases for and against the conservation of 14 names. The statements in this first contribution deal, *inter alia*, with the following genera: *Guignardia* Viala & Ravaz (1892) versus *Carlia* Bon. (1864) (nec Rabenhorst (1857)); *Sphaerella* (Fr.) Rabenh. (1856) versus *Sphaerella* Ces. & de Not. (1863), emend. Sacc. (1875), *Sphaerella* Sommerf. (1824), *Carlia* Rabenh. (1857), and *Mycosphaerella* Johans. (1884); *Uromyces* Link (1816) versus *Nigredo* Roussel (1806), *Caeomurus* (Link) S. F. Gray (1821), and *Pucciniola* Marchand (1829); *Urocystis* Rabenh. (1856) versus *Tuburcinia* Fr. (1832) [see next abstract]; *Hypochnus* Fr. (1829), emend. Schroet. (1889) versus *Lyomyces* Karst. (1881); *Poria* (Fr.) Karst. (1881) versus *Physisporus* Gillet (1874–7); *Tubercularia* Fr. (1829) versus *Tubercularia* Wiggers (1780), and *Knyaria* O. Kuntze (1891).

Urocystis versus Tuburcinia.—*Trans. Brit. mycol. Soc.*, xxiii, 2, p. 214, 1939.

The proposal of the Plant Pathology Committee of the British Mycological Society to conserve the name *Urocystis* Rabenh. (1856) against the name *Tuburcinia* Fr. (1832) [see preceding abstract] is based on the following grounds. (1) The name *Urocystis* has been well known to, and much used by, plant pathologists, and should not be discarded without cogent reasons; (2) the disuse of the name *Urocystis* is not dictated by the accession of any new knowledge, as *Tuburcinia orobanches* has been accepted as a species of *Urocystis* since 1877, when it was renamed *U. orobanches*; and (3) since 1877 the generic name *Tuburcinia* Fr. has been used in a rather different sense, as if it were founded on *T. trientalis* Berk. & Br., a species unknown to Fries; it is still a matter of taxonomic dispute whether species of *Tuburcinia* so used are properly classified in the same genus with the species of *Urocystis*. It is strongly urged that it is not in the interests of plant pathology that major pathogens such as *U. occulta*, *U. tritici*, and *U. cepulae* should be dispossessed of their well-known generic names for the sake of a less known one, the use of which since 1877 is open to suspicion. [Data regarding these two genera are fully set forth in the paper noticed in the preceding abstract.]

Bawden (F. C.). **Plant viruses and virus diseases.**—272 pp., 1 pl., 30 figs., 3 diags., 6 graphs, Leiden, Holland, The Chronica Botanica Company, 1939. 7 guilders.

'This is not . . . a text-book of virus diseases. Detailed descriptions of symptoms and host-ranges are not given, but all other aspects of the subject are treated' (author's preface). Following a brief historical introduction, two chapters are devoted to symptomatology, one to transmission and properties of viruses in expressed sap, and another to a discussion of the mechanism of insect-transmission and the relationship between viruses and their vectors. Chapter 6 deals with variation and acquired immunity. After a concise summary of serology in relation to plant viruses [*R.A.M.*, xviii, p. 540] three chapters are assigned to topics with which the author has been intimately concerned, viz., the purification of viruses and their chemical, physical, and optical properties. Methods of determining the sizes of virus particles are indicated and the evidence leading to the conclusion that the nucleo-proteins are the viruses themselves is critically discussed. The physiology of virus-diseased plants has been allotted one chapter. After notes on classification and control measures, the book concludes with a discussion on the origin and multiplication of viruses. There is an adequate index. This book, which provides a valuable summary of a large and scattered literature, should be accessible to all those interested in plant viruses.

Stanley (W. M.) & Loring (H. S.). **Properties of purified viruses.**—*Relaz. IV Congr. int. Pat. comp., 1939*, pp. 45–87, 5 figs., 5 graphs, 1939. [German, Spanish, French, and Italian summaries.]

The authors critically review the present state of knowledge regarding the comparative properties of virus proteins [cf. *R.A.M.*, xvii, p. 846; xviii, p. 212] and conclude that the several virus proteins are in fact the viruses themselves, and that virus activity must, therefore, be considered in terms of these proteins. The paper concludes with a discussion of a precursor-autocatalytic hypothesis and an alternative hypothesis of viruses as a type of living agent with an intra- rather than an inter-molecular structure. [This report is a slightly expanded version of the same authors' 'Properties of Virus Proteins', *Cold Spring Harbour Symp. Quant. Biol.*, vi, pp. 341–355, 1938.]

Giddings (N. J.). **A small cage for insect vectors used in plant inoculations.**—*Phytopathology*, xxix, 7, p. 649, 1 fig., 1939.

A description is given of a glass insect-container for inoculating plants by means of insect vectors which obviates the use of perishable rubber bands and unsatisfactory spring clips. It consists of a piece of glass tubing 22 mm. in diameter and 22 mm. high, a cloth cover, a grooved square of ground glass, a top bar, and two coil springs. The springs are attached to the bar and the glass square to hold the tubing inserted between them in position.

Baldacci (E.). **Ricerche sull' immunità acquisita in organi isolati e nei tessuti vegetati 'in vitro'.** [Researches on acquired immunity in

detached organs and in plant tissues *in vitro*.]—*Phytopath. Z.*, xii, 3, pp. 277–282, 3 figs., 1939.

This is an expanded account of the writer's experiments at the Pavia Agricultural Experiment Station, a preliminary note on which has already appeared [*R.A.M.*, xviii, p. 543], on the immunization by 'vaccination' of red clover (*T*[*rifolium*] *pratense*) leaves against *Macrosporium commune* [? *Stemphylium botryosum*: ibid., xviii, p. 141] and *Rhizoctonia solani* var. *ambigua*, and of maize roots against the latter organism.

Barthelet (J.). **La nutrition des végétaux et le parasitisme.** [Nutrition of crop plants and parasitism.]—*Ann. agron., Paris*, N.S., ix, 2, pp. 253–268, 1939.

In this paper the author reviews, with numerous references to the relevant literature, the present state of knowledge on the nutrition of crop plants in relation to susceptibility to attack by fungal and virus diseases.

Leonian (L. H.) & Lilly (V. G.). **Studies on the nutrition of fungi. II. Effect of inoculum on the growth of the colony.**—*Phytopathology*, xxix, 7, pp. 592–596, 2 figs., 1939.

In experiments made to ascertain whether an inoculum exerts an influence on the growth of the ensuing colony, the authors, using thiamin (vitamin B_1) and dextrose as test substances and *Phycomyces blakesleeanus* (which cannot grow without thiamin) as the test organism, demonstrated that for all practical purposes the quality and quantity of nutrients and auxithals present in the agar of an inoculum have no significant influence on the initiation and growth of the new colony.

Been (W. G.). **Incidence of Potato leafroll on Long Island.**—*Plant Dis. Reptr*, xxiii, 13, p. 219, 1939. [Mimeographed.]

Evidence obtained during a survey by K. H. Fernow, H. S. Cunningham, and the writer of over 200 potato fields on 74 farms on Long Island proved conclusively that the cause of the condition known locally as 'hairsprout' [*R.A.M.*, xvii, p. 701] is leaf roll.

Pethybridge (G. H.). **History and connotation of the term 'Blattrollkrankheit' (leaf-roll-disease) as applied to certain Potato diseases.**—*Phytopath. Z.*, xii, 3, pp. 283–291, 1939.

The author traces the history of the term 'leaf roll disease', introduced into phytopathological literature in 1906 by O. Appel (*Jb. Ver. angew. Bot.*, iii, p. 122) for a disease attributed to one or more species of *Fusarium*, and critically discusses its connotations in relation to certain virus and fungal diseases of potatoes. Some outstanding studies on the subject are briefly summarized, special credit being given to Quanjer and his associates in Holland for their recognition of phloem necrosis as the underlying cause of leaf roll. 'Blattrollkrankheit' is still the accepted name for phloem necrosis of virus origin of the potato in Germany, where it is clearly differentiated, however, from the *Fusarium* and *Verticillium* wilts to which the same term was formerly applied.

Jahnel (H.). **Wuchsstoffuntersuchungen an abbaukranken Kartoffeln. II.** [Auxin investigations on degenerate Potatoes. II.]—*Phytopath. Z.*, xii, 3, pp. 312–317, 1939.

Continuing his studies at the Botanical Institute of the Tharandt (Saxony) College of Forestry on the relation of the auxin content of Parnassia, Odenwälder Blaue, and Direktor Johanssen potato tubers to their state of health [*R.A.M.*, xvi, p. 706], the writer confirmed his previous observations both as to the larger amounts present in sound material and the readier response of the latter to the application of heteroauxin to the leaf spindles. In a test consignment comprising two lots each of Odenwälder Blaue and Erstling [Duke of York], one healthy and the other diseased, the author, without knowing the diseased condition of the tubers, correctly diagnosed the diseased and healthy lots of each variety on the basis of the auxin production as follows: Osterwälder Blaue, 10·4° and 4·9° corresponding to 100 and 47 per cent., as healthy and diseased, respectively, and Duke of York, 6·4° and 5·5° corresponding to 100 and 86 per cent. as apparently healthy and apparently diseased, respectively. The percentage of diseased plants in stands grown from unused tubers of the four samples were 31·58, 100·00, 30·25, and 98·95 per cent., respectively, thereby confirming the accuracy of the diagnosis. It is apparent from these results that a close correlation exists in potato tubers between liability to virus diseases and hormone metabolism.

Owens (C. E.). **Bacterial ring rot of Potato in Oregon.**—*Plant Dis. Reptr*, xxiii, 13, p. 223, 1939. [Mimeographed.]

Potatoes growing in eastern Oregon developed a severe outbreak of *Bacterium sepedonicum* [*R.A.M.*, xviii, p. 613] in 1939, some fields showing from 1 to 5 per cent. infection.

Lepik (E.). **Untersuchungen über den Biochemismus der Kartoffelfäulen. II. Über die Rolle der stickstoffhaltigen Bestandteile der Kartoffelknolle bei der Phytophthora-Fäule.** [Studies on the biochemistry of the Potato rots. II. On the role of the nitrogen-containing components of the Potato tuber in *Phytophthora* rot.]—*Phytopath. Z.*, xii, 3, pp. 292–311, 6 graphs, 1939.

Continuing his studies on the biochemistry of potato blight (*Phytophthora infestans*), initiated in Switzerland [*R.A.M.*, viii, p. 596], at the Dorpat (Estonia) Phytopathological Experiment Station, on Swiss material of the Erdgold, Iris, Wekaragis, and Kaiserkrone varieties, the writer found that judged by the heavy losses of total nitrogen (amounting to 4·225 per cent. on a dry weight basis) and proteins (from 0·7 to 1·5 per cent.) in diseased as compared with healthy tubers, the nitrogen-containing components of the tuber constitute the main source of energy for the fungus.

Murphy (P. A.). **A study of the seasonal development of the Potato plant in relation to blight attack and spraying.**—*Sci. Proc. R. Dublin Soc.*, N.S., xxii, 6–14, pp. 69–82, 14 graphs, 1939.

Observations made in 1933, 1934, 1936, and 1937 on Up-to-Date potatoes on which *Phytophthora infestans* was perfectly controlled,

commercially controlled, and untreated demonstrated that the first result of spraying is, as a rule, to check foliage and tuber production and reduce blossoming. Hence, spraying becomes beneficial only when it reduces infection later on. In 1933, when the weather was exceptionally dry, spraying increased foliage production.

Perfect control of blight with no appreciable injury resulted from weekly applications of cuprous oxide, used for the first two treatments at a concentration of only 0·05 per cent., and for the remaining twelve at one of only 0·075 per cent., the total amount of copper used for the season being only 5½ lb., as against 12 lb. for three applications of Burgundy mixture (1, 1, and 2 per cent.) at 120 gals. per acre, which gave only commercial control.

In the disease-free crop maximum production reached 1½ tons per acre per week. This was maintained for four weeks after blossoming, and then decreased, the September production being little more than half that for August. The period of maximum tuber production roughly coincided with that of maximum foliage production, the curve for total weight of haulms forming an almost regular arc. After the unsprayed crop had become infected, the decline in haulm production followed a sigmoid course. Tuber production suddenly ceased when the haulms were reduced to 55 per cent. of their maximum weight, at which time the leaves were 30 to 40 per cent. of their maximum weight. The amount of benefit to production due to spraying depends on the duration of the interval between the arrest of production due to blight on the foliage and the arrest of production due to normal maturation.

Le Clerg (E. L.). **Methods of determination of physiologic races of Rhizoctonia solani on the basis of parasitism on several crop plants.** —*Phytopathology*, xxix, 7, pp. 609–615, 1 fig., 1939.

In investigations conducted to study the variability in pathogenicity of a number of isolates of *Rhizoctonia* [*Corticium*] *solani* [cf. *R.A.M.*, xviii, p. 494] in relation to the possible identification of physiologic races damping-off experiments were made in three seasons in the greenhouse with 29 isolates of the fungus from potatoes and sugar beets, sugar beets, Detroit Dark Red table beets, and Grimm lucerne being used as possible differential hosts. The amount of damping-off that occurred was very variable for most of the isolates tested in all these experiments, as indicated by the large values of most of the coefficients of variability, though with a few isolates degree of variability was relatively small for each of the three hosts.

In more extensive experiments direct inoculations with 13 isolates from potatoes and sugar beets from widely separated localities were made on the underground stems of older plants of beans [*Phaseolus vulgaris*] (five varieties), soy-bean, peas, celery, tomato, cabbage, and carrot. With beans this method gave less variability in results between successive experiments than was the case in the damping-off experiments, but it is considered that the results with beans do not warrant identification of physiologic races, though under more favourable experimental conditions the method may become useful. None of the potato isolates was pathogenic to cabbage, while carrots appeared to be much more resistant to the potato isolates than to the sugar beet

isolates. On carrots and peas some isolates produced large or small sclerotia.

Davies (D. L. G.). **A rootstock canker of Hops caused by Gibberella pulicaris (Fr.) Sacc.**—*Rep. agric. hort. Res. Sta. Bristol, 1938*, pp. 115–123, 2 pl., [1939].

During 1938, hops in the Tenbury Wells area of Worcestershire were widely and severely affected by rootstock canker [*R.A.M.*, xvi, p. 367], the disease, which has been known since 1902 and came into prominence about three years ago, causing a total loss in many gardens. In addition to the symptoms previously described [ibid., ii, p. 132], infected hops often show pale green leaves with a mosaic-like puckering.

In the cases investigated in 1938 infection appeared to have originated at the cut ends of the 'straps' (i.e., at the bases of the bines of the previous season), and prevalence seemed to be associated with defective drainage. Infected 'straps' bore near the cut end the globose, conoid or ovoid, black perithecia of a species of *Gibberella*, arranged in irregular heaps, or scattered and solitary on a brown stroma, 0·22 to 0·42 by 0·16 to 0·3 mm., with a wall violet-blue to dark violet-blue by transmitted light and wrinkled and warted when dry. The clavate, almost sessile asci measured 73 to 105 by 12 to 15 μ, and were rounded at the apex. The obliquely uniseriate and biseriate, oblong-oval or fusoid, straight or curved, triseptate, hyaline, smooth ascospores measured 21 to 28 by 5 to 6 μ, and were slightly constricted at the septum. The fungus was identified as *G. pulicaris*. Single ascospores in culture produced the imperfect stage, *Fusarium sambucinum*. A *Fusarium* found on bines arising from the diseased straps produced in culture the perithecia of a *Gibberella* identical with those found on the diseased straps.

Experimental inoculations of the cut surface of hop runners in pots resulted in a browning of the cutting tissues extending downwards from the inoculated surface through the entire cutting. Perithecia formed on the inoculated surface. Shoots developed and wilted, and *F. sambucinum* was reisolated from the diseased material.

Notes from Sugar centres. Isis District.—*Aust. Sug. J.*, xxxi, 3, pp. 175–176, 1939.

A report on the progress up to 29th April, 1939, of the Fiji disease eradication campaign in the Isis district of Queensland [*R.A.M.*, xviii, p. 549] since the inception of intensified measures on 9th August, 1938, states that during the period under review 98 infected stools were found on 20 of the 189 farms visited, covering 4,922 acres of susceptible varieties; 136 blocks of planting material were inspected and found to be healthy. Since the present outbreak of the disease about three years ago, infection has been found on 34 farms, of which 14 would now appear to have eliminated the trouble, an encouraging indication of the successful outcome of determined efforts in this direction.

Tate (H. D.) & Vandenberg (S. R.). **Transmission of Sugar-cane mosaic by aphids.**—*J. agric. Res.*, lix, 1, pp. 73–79, 1939.

In transmission experiments conducted at Mayaguez, Puerto Rico, sugar-cane mosaic was successfully transmitted by *Carolinaia cyperi* and

Hysteroneura setariae [*R.A.M.*, xvii, p. 488], the percentages of inoculated plants becoming infected being 31·3 (60 out of 192) and 8 (11 out of 137), respectively, while *Aphis maidis*, used as a control, showed 34·5 per cent. (69 out of 200) infected plants. In most cases a considerably higher percentage of transmission was obtained on plants grown from seeds than on those grown from cuttings. *C. cyperi* is stated to occur in considerable abundance on the weed grass *Cyperus rotundus* and on a number of other grasses growing in and around sugar-cane fields throughout Puerto Rico. None of the three aphids feeds to any appreciable extent on sugar-cane in Puerto Rico, with the exception of localized infestations of *H. setariae*, and it appears that field dissemination of the disease is largely dependent upon insects that are more or less incidentally associated with sugar-cane.

Bisby (G. R.). **Trichoderma viride Pers. ex Fries, and notes on Hypocrea.**—*Trans. Brit. mycol. Soc.*, xxiii, 2, pp. 149–168, 5 figs., 1939.

In the light of an exhaustive study of specimens from herbaria and the field and numerous cultures, *Trichoderma viride* [*R.A.M.*, xviii, p. 295], the conidial stage of *Hypocrea rufa* (as confirmed by one mono-ascospore isolation), is considered to be a very variable species, particularly in the shape of the conidia, which are subglobose in some isolations and ovoid in others; the same variation is also found in the shape of the ascospores. A revised description is given and the species is made to include the following synonyms: *T. lignorum*, *Acrostalagmus viridis*, *T. koningi* [ibid., xviii, p. 485], *Eidamia viridescens* [ibid., xvi, p. 150], *Sporotrichum narcissi* [ibid., xiii, p. 796], *T. narcissi*, *A. koningi*, *T. nunbergii* [ibid., xi, p. 757], and *T. viridescens*. The author expresses the view that the genus *Trichoderma* is monotypic, other names in it requiring further examination. From the description *T. glaucum* is regarded as *T. viride* in the yellowish condition induced by an alkaline medium. *T. viride* was also obtained from ascospores of a specimen of *Hypocrea gelatinosa* and it is suggested that *H. gelatinosa* is only mature *H. rufa*. *H. pulvinata* produced in culture a conidial stage considered to belong to *Cephalosporium*; it is homothallic, and readily formed ascospores.

Groves (J. W.). **Some Pezicula species and their conidial stages.**—*Canad. J. Res.*, Sect. C., xvii, 5, pp. 125–143, 4 figs., 1939.

Descriptions are given of five species of *Pezicula* [see next abstract] and their conidial stages, the genetic connexion of which was established by cultures, viz., *P. carpinea* on *Carpinus caroliniana*, and its conidial stage *Cryptosporiopsis fasciculata*, *P. pruinosa* on *Amelanchier* (conidial stage, *Sphaeronema pruinosum* [*R.A.M.*, xv, p. 117]), *P. corni* on *Cornus* (conidial stage, *C. cornina*), *P. rubi* on *Rubus* (conidial stage, *Discosporiella phaeosora*), and *P. hamamelidis* n. sp. [of which a Latin diagnosis is given] on *Hamamelis virginiana*, with its conidial stage, *C.* sp. In culture the conidial stages, while retaining some of the characters as found in nature, tended to show a common form, consisting of a globose stroma with one or more cavities. The conidial spore itself remained somewhat constantly oblong-ellipsoid. In this group the form of the spore may, therefore, be more important in indicating relationships than that of the stroma.

Wollenweber (H. W.). **Diskomyzetenstudien (Pezicula Tul. and Ocellaria Tul.).** [Studies on Discomycetes (*Pezicula* Tul. and *Ocellaria* Tul.).]—*Arb. biol. Anst.* (*Reichsanst.*) *Berl.*, xxii, 4, pp. 521–570, 9 figs., 1939.

On the basis of exhaustive studies at the Biological Institute, Dahlem, Berlin, of field material, exsiccata, and pure cultures the author gives amended descriptions of nine species of *Pezicula* [see preceding abstract], viz., *P. livida*, *P. rubi*, *P. plantarium* n. sp., *P. cinnamomea*, *P. pruinosa*, *P. carpinea*, *P. frangulae*, *P. crataegi* (syn. *P. corticola*, the ascigerous stage of *Myxosporium corticola*) [*R.A.M.*, xv, p. 468], *P. malicorticis* (Jackson) Nannfeldt (syn. *Neofabraea malicorticis*), and *Ocellaria ocellata*, a key for the determination of the species being furnished. The conidial stages of the fungi under discussion were all found to belong to *Cryptosporiopsis* Bub. & Kab. sensu extenso: a key is provided for their identification in the absence of the perfect forms. The generic conception of *Cryptosporiopsis* is discussed in relation to a number of other related genera, with special reference to the consideration of their pycnidial and spore septation characters for the avoidance of ambiguities of classification. The author considers that *Gloeosporium perennans* is the conidial stage of an unknown *Pezicula* and renames it *C. perennans* n. comb.

In inoculation experiments on Ananas and Coulon Renette and Baumann's apples and on quinces a definite rot, advancing similarly to that produced by *Phacidiella discolor* [ibid., xvi, p. 690] and rather more slowly than the decay due to *Diplodia pseudodiplodia* [*Physalospora obtusa*], was caused by *Pezicula livida* from pine, *P. cinnamomea* from oak, *P. frangulae* from *Rhamnus frangula*, *P. malicorticis* from *Pyrus* [*malus*], and *P. plantarium* from sweet cherry [ibid., xviii, p. 507]. The last-named [which is supplied with a Latin diagnosis] is characterized by dark olivaceous, spherical or oval to conical or sinuous pycnidia, 0·2 to 0·6 mm. in diameter (average 0·38 mm.), with ovoid to oblong, cylindrical, mostly straight, 1- to 7- (usually tri-) septate pycnospores, measuring 18 to 60 by 9 to 18 μ (mostly 27 to 50 by 11 to 15 μ) and extruded in white to isabelline or cream-coloured drops or cirrhi; elongated, turbinate to truncate, orange, erumpent apothecia, 0·7 to 2 by 0·5 to 2·4 (0·9 to 1·3 by 0·6 to 1·7) mm., with stalks 0·4 to 1 by 0·2 to 0·8 (0·8 by 0·5) mm., filiform paraphyses, and clavate asci, 65 to 200 by 15 to 26) (110 to 160 by 17 to 23) μ, containing eight (rarely four or six) yellowish-white to cream-coloured, fusoid to reniform, 1- to 7- (mostly tri-) septate ascospores, 15 to 37 by 6 to 11 (19 to 31 by 7 to 9) μ. Both asco- and pycnospores may give rise on germination to a few evanescent, rod-shaped spermatia, 3 to 10 by 1·2 to 3 (4 to 7 by 1·4 to 2) μ, produced directly on the membrane or borne on short sterigmata. Negative results were given in tests with *P. carpinea*, *P. crataegi*, and *O. ocellata*, while *P. rubi* and *P. pruinosa*, being represented only by herbarium specimens, could not be included in the trials.

Konstantinia-Sulidu (Aekaterini). **Parasitische Pilze Mazedoniens.** [Parasitic fungi of Macedonia.]—*Hedwigia*, lxxviii, 5–6, pp. 284–298, 1939.

This is an annotated list of some 175 parasitic fungi collected on

various cultivated and wild hosts in the vicinity of Salonika and other parts of Macedonia (Greece).

Tcheremissinoff (N. A.). Грибы, собранные в Хреновском государственном степном заповеднике. [Fungi collected in the Khrenovoy Steppe State Reservation.]—*Тр. Воронежск. Госуд. Унив.* [*Trans. Voronezh St. Univ.*], x, 5, pp. 7–15, 1939. [English summary.]

This is a list of 118 fungi, chiefly powdery mildews and rusts, collected during excursions in the summers of 1936 and 1937 in the Khrenovoy Steppe State Reservation in the Voronezh district of the U.S.S.R.

Kausche (G. A.), Guggisberg (H.), & Wissler (A.). **Quantitative Untersuchung der Strömungsdoppelbrechung von Tabakmosaik und Kartoffel-X-Virus.** [The quantitative investigation of the double refraction of flow of the Tobacco mosaic and Potato X-viruses.]—*Naturwissenschaften*, xxvii, 18, pp. 303–304, 3 graphs, 1939.

At the Biological Institute, Dahlem, Berlin, the variation of the extinction angle of a solution of tobacco mosaic virus with the streaming gradient was determined and compared with those of aqueous colloidal methylcellulose and sodium thymonucleate (molecular weights 38, 100, and 7×10^6, respectively). The resultant data indicate that individual virus particles have a very high molecular weight, running into many millions [*R.A.M.*, xviii, p. 714]. The extent of positive double refraction of the virus solution obeys the laws of ideal dilute solutions. For each streaming gradient the optical anisotropy is proportional to the concentration of tobacco mosaic virus over the range 0·0004 to 0·002 gm. per c.c. The extinction angle curve is unaffected by concentration. Probably no dissociation or variation in form of the virus particles takes place on dilution of the solution. The determination of double refraction can be used to ascertain the concentration even of very dilute virus solutions. Solutions of the potato virus X showed essentially the same double refraction properties as tobacco mosaic, but the orientation of the presumably much more slender particles is less complete.

Valleau (W. D.). **Symptoms of yellow ring spot and longevity of the virus in Tobacco seed.**—*Phytopathology*, xxix, 6, pp. 549–551, 1939.

Seedlings derived from seed of a yellow ring-spot tobacco plant [*R.A.M.*, xv, p. 831] at the Kentucky Agricultural Experiment Station developed chlorosis but seldom showed the ring or line patterns characteristic of the disease. These were obtained, however, on plants inoculated with the juice from the chlorotic seedlings. Under natural conditions, therefore, ring spot may persist indefinitely from one plant generation to another without the production of any of the patterns commonly regarded as typical of the disease, these being inoculative and invasive symptoms manifest only after the virus has entered the growing point and become truly systemic. At this stage the yellowing strain induces partial foliar bleaching, sometimes accompanied by marginal necrosis, the latter being the chief feature of infection by the green strains, which under certain conditions may also induce slight darkening and stunting of the plants. In one test on the longevity of the yellow

ring-spot virus in Turkish tobacco seed, the percentage of transmission declined from 12·1 at harvest to 0 after 1,841 days. In another experiment with six lots of seed the virus withstood 5½ years of storage.

JOHNSON (E. M.). **Destructive epidemic of bacterial leaf spots in Kentucky.**—*Plant Dis. Reptr*, xxiii, 11, pp. 192–193, 1939. [Mimeographed.]

A survey of the Western Kentucky tobacco seed-beds in 1939 revealed the presence of angular leaf spot (*Bacterium angulatum*) and wildfire (*Bact. tabacum*) [*R.A.M.*, xviii, p. 576] on 21st and 25th April, respectively. Both diseases, especially the latter, subsequently assumed a destructive character in areas to which liquid Bordeaux treatments were not applied, up to 75 per cent. of the stands being killed by the wet-rot stage. Out of a total of 207 Bordeaux-treated beds inspected in three counties only two were diseased (the organisms being already present at the time of application), whereas of 279 untreated beds 79 were attacked by wildfire and 86 by angular leaf spot.

REID (J. J.), FARRELL (M. A.), & HALEY (D. E.). **Bacterial leaf spot diseases.**—*Science*, N.S., lxxxix, 2320, pp. 566–567, 1939.

In investigations at the Pennsylvania Agricultural Experiment Station, evidence has been obtained that *Phytomonas tabaca* [*Bacterium tabacum*] is a transitory physiological adaptation of *Pseudomonas fluorescens* [*R.A.M.*, xviii, p. 553], a species which occurs abundantly in various physiological adaptations on normal tobacco. All Pennsylvania cigar-leaf tobacco is exposed to it throughout growth and ripening but infection in the field only takes place under conditions of unsatisfactory nutrition.

Relative virulence varied widely with the source of the isolation of *P. fluorescens*, and distinct physiological characteristics were typical of the different isolates. Increase and decrease of virulence were readily induced in the laboratory. Serologically, virulence appeared to be associated with the specific nature and amount of the capsular material of the cell. Other factors being equal, the most virulent adaptations are unable to cause economic loss in plants adequately nourished.

Tobacco of the cigar-filler type is strongly resistant to infection during the growing period. At maturity, the leaves usually contain between 3 and 4 per cent. nitrogen and between 4 and 5 per cent. potassium. It is not the exact nitrogen level, but the ratio of nitrogen to certain minerals within the plant that is important in determining resistance or susceptibility, the stage during which high nitrogen uptake occurs also being an extremely important factor. Accumulation of more nitrogen than potassium induces susceptibility. Potassium is the element most needed to promote resistance, and appears to be the one most frequently deficient in Pennsylvania.

It is during the ripening period that faulty agricultural practices induce the greatest susceptibility. Whatever the nutrition of the plant previously, the uptake of significant amounts of nitrogen during ripening appreciably lowers resistance. Practices inducing severe outbreaks are (in descending order of importance): the incorporation of large amounts of organic nitrogen in the soil, the use of excessive nitrogen and in-

sufficient potash in fertilizer treatments, over-liming, and poor tilth. Practices tending to produce resistant plants of high quality and good yield are: rotation, liberal dressings of well-rotted manure, applications of a well-balanced fertilizer containing less organic than inorganic nitrogen, and suitable cultural methods.

VAN DER MEER MOHR (J. C.). **Verslag van het Deli Proefstation over het jaar 1938.** [Report of the Deli Experiment Station for the year 1938.]—*Meded. Deli-Proefst.*, Ser. 3, iii, 38 pp., 1939.

The following items of phytopathological interest occur in this report [cf. *R.A.M.*, xvii, p. 777]. On many estates there were two distinct periods of tobacco leaf spot (*Cercospora nicotianae*) development, one mainly involving the first sand leaves and causing relatively little damage, and the second, after a month's quiescence, characterized by severe infection, especially of the fermenting foliage. The field spotting is white and that developing in the curing barn green.

The average incidence of slime disease (*Bacterium solanacearum*) [ibid., xviii, pp. 481, 554] was 11·6 per cent. compared with 10·7 in the previous year. The number of seed-beds ploughed up on account of the disease was 52,966 (57,604 in 1937).

The American recommendation of trisodium phosphate for the disinfection of the coolies' hands to prevent mosaic transmission is fully endorsed [ibid., xviii, p. 554]. The compound is used at a strength of 8 per cent. with 4 per cent. sodium soap. Less effective than the foregoing, but useful where trisodium phosphate is unobtainable, is a mixture of 10 per cent. soda and 4 per cent. soap. No doubt the toxicity of these salts to the virus is a function of their strongly alkaline reactions (P_H 12·5 for trisodium phosphate and 11·2 for soda).

Pseudo peh-sim or false mosaic [ibid., xvii, p. 777] was very troublesome in places, 60 per cent. of the plants in one section having been unfit for plucking. The disorder, in the transmission of which Aleyrodidae are suspected, was specially prevalent in scantily irrigated fields.

There was a noticeable decrease in the extent of infection by *Phytophthora parasitica* var. *nicotianae* [ibid., xviii, p. 554], which necessitated the ploughing-up of only 664 beds as compared with 1,310 in 1937.

Notes are given on a number of other diseases of less widespread importance than those already mentioned.

BLOOD (H. L.) & CHRISTIANSEN (R. M.). **The Utah Tomato disease situation in 1938.**—*Plant Dis. Reptr*, xxiii, 10, pp. 165–169, 1939. [Mimeographed.]

In these notes on diseases of the Utah tomato crop it is stated that bacterial canker (*Aplanobacter michiganense*) caused more damage (7·6 per cent.) in 1938 than in any year since the adoption of fermentation during seed extraction [*R.A.M.*, xiv, p. 682] or acetic acid seed treatment for the control of the disease [ibid., xvii, p. 79]. Infection predominated in home-grown plants, certain fields among the 280 acres planted with which showed up to 100 per cent., with an average for the total area of 14·2, the corresponding figures for the 282·5 acres supplied with plants from the Moapa Valley, Nevada, being 16 and 1·5 per cent., respectively. The seed for planting both the Moapa Valley and the

local seed-beds came from the same source, and it is therefore concluded that the local beds were responsible for the major portion of the infection.

Bohn (G. W.) & Tucker (C. M.). **Immunity to Fusarium wilt in the Tomato.**—*Science*, N.S., lxxxix, 2322, pp. 603–604, 1939.

Greenhouse and field tests with tomato varieties reputedly resistant to *Fusarium bulbigenum* var. *lycopersici* [*R.A.M.*, xviii, p. 557] showed that under conditions strongly favouring infection practically all the varieties became diseased. When numerous accessions of *Lycopersicum* and related genera were exposed to infection by virulent isolates of the fungus, all species in genera other than *Lycopersicum* remained immune. Accessions of *L. esculentum* were all susceptible. One strain of *L. pimpinellifolium* was very susceptible, several were resistant, and one, No. 160, remained immune under conditions highly favouring infection, even an injection of a suspension of a virulent isolate into the stems failing to produce the disease.

Tests of thousands of plants in various progenies from crosses between Accession 160 and susceptible commercial varieties proved that immunity to the fungus in tomatoes depends on a single, dominant genetic factor. The factor for immunity was maintained in the heterozygous condition in a series of four back-crosses to susceptible varieties. Its potency was not reduced in the fourth back-crosses or their progenies. Large fruit size and other commercially valuable qualities were obtained in some plants of advanced generations, and many of the plants were indistinguishable from large-fruited forms of *L. esculentum*. Although they were heterozygous for many factors affecting fruit and plant characters, some plants in progenies from self-pollinated flowers of selections derived through out-crossing immune selections to commercial varieties for four generations were homozygous for immunity.

Weber (G. F.). **Nailhead spot of Tomato caused by Alternaria tomato (Cke) n. comb.**—*Bull. Fla agric. Exp. Sta.* 332, 54 pp., 19 figs., 1939.

Nailhead spot of tomato, first reported in Florida in 1913, reached the zenith of destructiveness in 1923–4, causing a loss of 50 per cent. of the crop in that State for these two seasons. Since 1925 it has become less prevalent until at the present time it is as unimportant as in 1914. The reason for this marked reduction of the disease is partly the almost universal cultivation of the resistant Marglobe variety. The disease also caused losses estimated at $1,000,000 in Mexico in 1927 and occurs in Cuba, the West Indies, and probably in Central American countries. A complete description is given of the symptoms of the disease, with special emphasis on the characters distinguishing it from other diseases with which it has been confused, such as blossom-end rot [*R.A.M.*, xviii, p. 637] (following Galloway's misinterpretation of Cooke's description). A comparison of specimens of nailhead spot with Cooke's type material left no doubt of the identity of the Florida disease. The causal fungus, originally named *Macrosporium tomato* Cooke, is renamed by the author *Alternaria tomato* n. comb. [cf. ibid., xiii, p. 809], since he regards the names *A. tomato* (Cooke) Jones and *A. tomato* (Cooke) Brinkman [ibid., x, p. 767] as based on misidentifications [but see Art. B. 54 of the Inter-

national Rules of Botanical Nomenclature which validates Jones's name: ibid., xvi, p. 482].

Grown at room temperature on 2 per cent. potato dextrose agar the fungus produces after several days a characteristic crystalline substance, probably an alkaloid-glucoside combination closely related to solanin, the crystals developing from focal points and spreading fan-shaped in all directions. The optimum temperature for the growth of the fungus in culture was between 24° and 27° C., no growth developing at or below 5° and at or above 34°. The fungus grew at hydrogen-ion concentrations ranging from P_H 3·3 to 9, the optimum being on the alkaline side just past neutrality. In inoculation experiments in the greenhouse the host range of the fungus was extended to include horse nettle (*Solanum carolinense*), eggplant, and potatoes; in another test the most resistant of all tomato varieties was Marvel, followed by Marglobe, Globe, Cooper's Special, Magnus, Dwarf Champion, John Baer, and Earliana, the two last-named being very susceptible. Young tomatoes were more susceptible than older ones, but 'mature green' fruits (with smooth and glossy skin) are no longer attacked.

The fungus was found to remain viable on diseased foliage and stems from one season to the next; it may also survive on fruit skins left in the field after picking. Conidia are produced in abundance throughout the growing period of the host and are spread by wind, rain, running water, cultivators, and pickers. Infection may take place at any time when conditions are favourable (at temperatures of 15° to 30° and comparatively high humidity). The incubation period varies from three to five or up to ten days, and mature spores may appear six to eight days after inoculation, though under field conditions this period is usually lengthened to ten days or a fortnight.

THOMPSON (G. E.). **A leaf blight of Populus tacamahaca Mill. caused by an undescribed species of Linospora.**—*Canad. J. Res.*, Sect. C., xvii, 7, pp. 232–238, 1 pl., 2 figs., 1939.

A disease of *Populus tacamahacca*, which is stated to occur in Alberta, British Columbia, Ontario, and Quebec, is ascribed to *Linospora tetraspora* n. sp. The disease causes severe damage to the foliage on young trees and on the lower branches of the older trees; the lesions vary considerably in size, have irregular and diffused margins, and are dark brown on the upper and reddish brown on the under surface of the leaf. Eventually the entire leaf may become discoloured, and numerous small, black, circular or irregular pseudoclypei then develop on the upper surface. No true conidial stage of the fungus was found, but a spermatial stage was observed in the lesions during late summer and autumn, the acervuli, in which the spermatia were produced, arising within the epidermal cells of the upper surface of the leaf. No species of *Linospora* has been recorded on poplars in North America, and the fungus under investigation differs from those occurring on poplar in Europe (*L. populina* and *L. candida*) in having longer asci and ascospores, and four-spored asci. The new species, of which a Latin diagnosis is given, is described as having black, epiphyllous, densely scattered pseudoclypei, composed of dark mycelium in the epidermal cells; pseudostromata, 400 to 750 by 200 to 250 μ, develop beneath the pseudoclypei and

globose or piriform perithecia, 175 to 270 by 110 to 175 μ, usually occur singly in the pseudostromata; the beak of the perithecium arises laterally, then bends at a right angle to reach the leaf surface; the asci are cylindrical, straight or curved, tapering to a narrow base, rounded and thickened at the apex, 175 to 230 by 6·5 to 9 μ, and four-spored; the ascospores are filiform, straight or irregularly curved, with 6 to 8 septa, hyaline, 175 to 225 by 2·5 to 3 μ, and spirally twisted within the ascus.

In culture ascospores liberated from mature perithecia germinated within 24 hours, and slowly formed whitish, later brownish colonies; similar colonies were produced by plantings of infected leaf tissue, whereas single ascospores failed to grow. No fructifications were developed in culture. The pathogenicity of the fungus was demonstrated by inoculation of the terminal leaves on three branches of a healthy young tree of *P. tacamahacca* with a suspension of ascospores, the fungus being later reisolated from the diseased tissue.

Statutory rules and orders, 1939, No. 532. Destructive Insect and Pest Acts, England. The Importation of Plants Order of 1939. Dated May 16, 1939.—12 pp., 1939.

This order (which became effective as from 1st June, 1939), amends and consolidates the existing regulations (embodied in the Importation of Plant Orders of 1933 to 1938) [*R.A.M.*, xii, p. 799 *et passim*] affecting the importation of plants into England and Wales, which are now revoked. Corresponding regulations have been introduced in Scotland.

St. Lucia. Statutory Rules and Orders, 1939. No. 15. 24th June, 1939.—1 p., 1939.

In order to guard against the introduction of witches' broom disease of cacao [*Marasmius perniciosus*: *R.A.M.*, xvii, p. 801], this proclamation by the Governor in Council prohibits the importation into St. Lucia of any oil sands coming directly or indirectly from Trinidad.

Proclamation No. 8 of 1939.—*Nyasald Govt Not.* 37, 1 p., 1939. [Mimeographed.]

Proclamation No. 8 of 1939 (made under the Nyasaland Plant Pests and Diseases Ordinance [of 1924; *R.A.M.*, iv, p. 255]) prohibits the introduction into Nyasaland of plants or portions of plants (except the fruit) of grape vines, *Ampelopsis*, Virginia creeper [*Parthenocissus*], or other plant of the family Vitaceae, from the districts of Somerset West, Stellenbosch, Worcester, and Wynberg in Cape Province, South Africa, unless certified by the Union Department of Agriculture as free from bacterial blight (*Bacillus vitivorus*) [ibid., xviii, p. 498].

Service and regulatory announcements. January–March, 1939.—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 138, pp. 31–53, 1939.

Summaries are given of the plant quarantine import restrictions in force in Albania, Bolivia, and Korea; revised import restrictions for Ceylon and the Gold Coast; and supplementary regulations for Australia, Malay, Nigeria, Jamaica, Greece, Yugoslavia, Rumania, and Italy. A list is also given of current domestic and foreign plant quarantine restrictions and miscellaneous regulations at present in force in the United States.

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Guba (E. F.). **Control of Tomato leaf mold in greenhouses.**—*Bull. Mass. agric. Exp. Sta.* 361, 36 pp., 7 figs., 1939.

In Massachusetts leaf mould of tomatoes (*Cladosporium fulvum*) [*R.A.M.*, xviii, p. 637] is stated to be of importance only in greenhouses, where it is associated with the high temperatures and high relative humidities prevailing during the warm months of the year and occurs when the difference between the inside and outside mean minimum temperatures is least. Recommendations for the control of the disease include proper spacing; leaf pruning below the fruit; not too excessive bottom watering, permitting the foliage to be kept dry, done preferably in the morning and on bright days to ensure dry conditions at night; and finally ventilation and heating in order to maintain minimum temperatures between 60° and 65° F. in the spring and early autumn and free ventilation throughout the milder months. In control demonstrations, based on the above-mentioned recommendations, the percentage of diseased leaflets, tabulated at each pruning, was in some seasons considerably lower under good than under poor management, while in other seasons the difference was not significant. Comparative experiments with air-conditioning apparatus did not justify its installation, while the advantages of minimum thermostatic temperature control over hand valve control in greenhouses are recognized. Greenhouse design and location are important factors in control. Adequate ventilation and air circulation are ensured in single greenhouses, built without the connecting covered alley, all of glass, with a high ridged, even-span roof, and continuous ventilation on sides, ends, and span, situated in exposed, unsheltered positions.

The vaporization of sulphur beginning in April and continued at intervals of about 10 days until the end of June and then again before planting in the autumn until early November is recommended. The sulphuring of the hot steam pipes is rejected as the pipes are usually only hot enough to make the sulphur fume and consequently the greenhouses must be closed for a considerable length of time, which encourages the progress of the disease. The use of fungicidal sprays and dusts is considered to be ineffective, giving an inadequate protection for the lower surfaces of the leaves.

Disinfection of the greenhouse interior with chemical fumigants, of which burning sulphur has received most recognition for being

economical, practical, and lethal both to fungi and most insects, should be done just before the finished planting is cleaned out. The burning of sulphur at the rate of 4 lb. to 10,000 cu. ft. under dry conditions is considered to be safe, whereas greater quantities are harmful to iron frames and piping, wires, metal gutters, and paints containing zinc, the resulting residues dissolving in dripping water and causing injury to succeeding plantings. For these reasons only paints free from zinc and tinned or uncoated steel trellis wires should be used. Formaldehyde vapours were found to be inert to paint and metal, but lethal to the fungus. In a greenhouse of 10,000 cu. ft. a dosage of 24 fluid oz. of formaldehyde and 20 oz. of potassium permanganate, with 24 hours exposure to the vapour, killed both fungal spores and plants. The cost of this treatment was about 53 cents as compared with 16 for sulphur at the rate suggested. The use of formaldehyde as a soil-sterilizing agent combined with carbon disulphide emulsion against nematodes (exposure for two to three days) produces a greenhouse atmosphere strongly lethal to fungus spores and most insects.

Bier (J. E.). **Septoria canker of introduced and native hybrid Poplars.**—*Canad. J. Res.*, Sect. C., xvii, 6, pp. 195–204, 5 pl., 1939.

Septoria musiva Peck, a common leaf-spotting fungus of poplars in North America, has been observed causing a destructive canker on the introduced hybrids *Populus rasumovskyana*, *P. petrowskyana*, and *P. berolinensis* (of Russian origin), and the native hybrids between *P. tacamahacca* and *P. balsamifera* known as North-west and Saskatchewan poplars in Saskatchewan and Ontario. The affected trees show a number of lesions on the trunk and branches which ultimately girdle and kill the affected parts; the trees also form numerous new branches from adventitious buds on the stem and frequently sucker shoots that may develop into trees later. In addition to cankers, leaf lesions appear three or four weeks after the opening of the buds, at first on the leaves of the lower branches only, but infection rapidly spreads throughout the tree, though without causing defoliation. These lesions may be circular or angular and are brown with yellowish to white centres. They may coalesce to involve large areas of the leaf.

Field observations and artificial inoculations showed that cankers originate in the bark of twigs of the current year, the fungus entering the host through mechanical wounds and uninjured lenticels, stipules, and leaf petioles. By the middle of June one or more dead leaves may be observed on the leaders, at the ring scars, or on the axillary branches. The diseased bark is usually black with yellowish to white areas in which small pycnidia may be found. Girdled branches usually die during the first growing season, the infection then spreading to the main stem, where the perennial cankers develop, which ultimately kill the tree during its fourth or fifth year of growth.

The pycnidia, which vary in width from 64 to 120 μ (average 88 μ), and in height from 68 to 129 μ (average 96 μ), are embedded in the tissues, with projecting ostioles. The pycnospores are discharged in long, curled, pinkish cirrhi; they are hyaline, continuous to four- (mostly two-) septate, 17·2 to 57 by 3 to 4 μ. In late August, September, and October, small pycnidia, which are apparently spermogonial

structures, filled with rod-shaped, one-celled, hyaline spores, 4 to 7 by 1 to 2μ, are found on the lesions. The perfect stage of the fungus was identified as a species of *Mycosphaerella* with cylindrical, short-stipitate, eight-spored asci, 51 to 73 by 12 to 17 μ, and hyaline, uniseptate ascospores 17 to 24 by 4 to 6 μ. *S. musiva* is considered to be indigenous to North America and is not known to occur elsewhere. In addition to the cankers combined with leaf spot caused on the above-mentioned hosts, the fungus was also found to produce leaf injury on cottonwood (*P. balsamifera*), aspen (*P. tremuloides*), *P. tacamahacca*, *P. candicans*, and *P. trichocarpa* in Quebec, Ontario, Manitoba, Saskatchewan, and Alberta.

The spores germinated readily on potato dextrose agar, and the resulting colonies were white at first but became greenish with white margins. In inoculation experiments under greenhouse conditions with water suspensions of conidia from single ascospore cultures, leaf lesions, identical with those found in nature developed on both the native and the introduced species in from 7 to 21 days after inoculation, and the fungus was re-isolated. Inoculations on wounded stems yielded small brownish to black lesions, which developed for about a month only on *P. tacamahacca* and cottonwood before being delimited by a periderm, whereas those on the Russian and native poplars continued to grow. Inoculations on unwounded stems resulted in the production of cankers at the bases of leaves and surrounding lenticels on the Russian hybrids and the North-west and Saskatchewan poplars only. Inoculum derived from cottonwood produced leaf spots and cankers similar in character to those originating from the Russian poplars.

The presented data are held to exemplify the danger of a native fungus of minor importance with regard to native species becoming an aggressive parasite on new hosts.

TYLER (L. J.), PARKER (K. G.), & PECHUMAN (L. L.). **The relation of Saperda tridentata to infection of American Elm by Ceratostomella ulmi.**—*Phytopathology*, xxix, 6, pp. 547–549, 1939.

The common elm borer (*Saperda tridentata*), which is very prevalent in the Dutch elm disease (*Ceratostomella ulmi*) [*R.A.M.*, xviii, p. 717 and next abstract] area adjoining New York City [ibid., xv, p. 327], was found in the course of routine isolations covering a period of four years to be frequently carrying the fungus on emergence from infected logs. In greenhouse inoculation experiments through the feeding wounds of the insects on caged two- to four-year-old budded trees of *Ulmus americana*, infection took place in 1 out of 4 in 1936, 1 out of 8 in 1937, and 10 out of 20 in 1938. Inoculation by means of beetles actually carrying *C. ulmi* was slightly more successful than the entirely artificial method of atomizing the wounds, after the removal of the insects, with the spores of the organism.

WALTER (J. M.). **Observations on fructification of Ceratostomella ulmi in England.**—*Phytopathology*, xxix, 6, pp. 551–553, 1939.

During the past three years the coremia and perithecia of *Ceratostomella ulmi* were found in abundance under humid conditions in dead, dying, and fallen elm trees [see preceding abstract] and logs in the vicinity of Oxford, England. The fructifications occurred in the galleries

of *Scolytus scolytus* and *S. multistriatus*, on the inner bark surface and between the inner bark flakes, on the outer xylem surface, and on the cut and broken surfaces of infected wood. The mycelial-conidial stage of the fungus was also occasionally observed between the loosening bark and the outer xylem surface. The development of the perithecia ceased during November and was not resumed before the middle of the following March, the earliest dates on which these organs were found with ascospore slime exuding being 15th April, 1936, 9th April, 1937, and 31st March, 1938. Perithecia were commonly most profuse on surfaces that had produced dense stands of coremia two to four weeks earlier, and undoubtedly serve to extend the period of fresh spore supplies to a given bark or wood surface. Coremia were detected once in nature on the outer bark, but perithecia developed on this substratum only on *Ulmus americana* branches in moist chambers.

HAHN (G. G.). **Susceptibility of seedlings of Ribes punctatum, an Andine Currant, to Cronartium ribicola.**—*Phytopathology*, xxix, 7, pp. 643–644, 1939.

The author reports the susceptibility of *Ribes punctatum*, a native of the Andes in Chile and the Argentine, to *Cronartium ribicola* [*R.A.M.*, xviii, p. 323] and points out that the species should prove of use as a source of teleutosori inoculum for infection tests in the greenhouse in autumn and winter.

MURRILL (W. A.). **The cause of pecky Cypress.**—*Bull. Torrey bot. Cl.*, lxvi, 2, pp. 87–92, 1939.

In July, 1938, the author noted a cypress (*Taxodium distichum*) tree in Florida bearing a six-years-old bracket of *Fomes geotropus* [*R.A.M.*, xv, pp. 471, 759] on the trunk 3 ft. above the ground. The fungus is regarded as the cause of 'pecky' cypress, used in the United States for antiques and interior finishing. The decay was traced from the hollow base upward to its termination in sound wood, infection having probably occurred at a wound near the base. The formation of a bracket appears to be rare.

ELLIS (D. E.). **Ceratostomella ips associated with Ips lecontei in Arizona.**—*Phytopathology*, xxix, 6, pp. 556–557, 1939.

The blue-staining fungus, *Ceratostomella ips* [*R.A.M.*, xv, pp. 544, 827; xvii, p. 699; xviii, p. 488], was isolated from 45 out of 54 adult bark beetles (*Ips lecontei*) removed from freshly made galleries in standing *Pinus ponderosa* trees in the Prescott National Forest, Arizona, dipped in 50 per cent. alcohol, and dropped on to malt agar slants in the field. Stained and unstained fragments of wood from the edges of the galleries also consistently yielded the same fungus in culture. This is believed to be the first record both of *C. ips* in the south-west and of its association with *I. lecontei*.

JØRGENSEN (C. A.), LUND (A.), & TRESCHOW (C.). **Undersøgelser over Rodfordaerveren, Fomes annosus (Fr.) Cke.** [Studies on the root-destroyer, *Fomes annosus* (Fr.) Cke.]—*K. VetHøjsk. Aarsskr., 1939*, pp. 71–128, 8 figs., 1939. [English summary.]

On the basis of a regional survey of Danish forests, the total annual loss due to wood destruction by *Fomes annosus* on Norway spruce

[*Picea abies*], the principal conifer grown in the country, is estimated at Kr. 1,000,000.

No definite correlation could be established between the incidence of heart rot and soil type, though the disease tended to assume a more virulent character on sand than on clay. Sitka spruce [*P. sitchensis*] was found to be the most susceptible host of the fungus, followed by Weymouth pine [*Pinus strobus*], while certain *Abies* spp. and Austrian pine [*P. laricio* var. *nigra*] are highly resistant. An intermediate degree of susceptibility was shown by *P. contorta* and silver fir [*A. alba*], while Douglas fir [*Pseudotsuga taxifolia*], larch, and Scots pine [*Pinus sylvestris*] were fairly resistant. Young trees were uniformly more resistant than old ones, and where the Norway spruce is cultivated on the same area for two or more generations, heart rot generally increases in severity. Heavy thinning is recommended as a means of reducing infection, beginning when the stands attain an age of 20 to 25 years and continuing at bi- to triennial intervals.

On a spruce sawdust medium *F. annosus* grew well at acid reactions (initial P_H 3·9, 4·6, and 6·1, end 4·1, 3·9, and 4·4 after 19 months), but not at 7 or 8 (6·3 and 6·4); in sterilized raw humus the hydrogen-ion concentration was of less importance, good development being secured at a range from 4 to 6·8 (4·8 to 6·3 at the close of the test). On a synthetic nutrient medium asparagin and peptone provided the best sources of nitrogen, while humic acid was the most readily assimilated of the carbons.

Dead roots attached to the trunk bases were found to be the chief sources of infection. In a series of inoculation experiments in which the mycelium of the fungus was introduced into a transverse cut on a damaged tap-root, positive results were obtained in 9 cases out of 14, infection spreading from the dying part of the root through the trunk base to a height of between 30 and 70 cm. in the course of a year.

While judicious thinning is the sole feasible method of control in existing spruce stands, the relative susceptibility of the different conifers to *F. annosus* should be considered in the laying-out of new ones. Rotation with deciduous trees (birch or alder) may be advantageous, or broad-leaved trees may be interplanted with conifers. Sowing is preferable to planting in new cultures. An endeavour should be made to induce a relatively shallow growth habit, with the roots spreading out flat in the uppermost soil layers. Protection may also be afforded by the application of lime, Bordeaux-lime, or insoluble phosphates of alkaline reaction to the soil surrounding the young plants, and experiments along these lines are proposed.

Airola (E. V.). **Valmiiden massapaalien höyrysteriloimisen mahdollisuuksista.** [Possibilities of sterilizing pulp bales by the use of steam.]—*Finsk PappTidskr.*, *1939*, 7a, pp. 132–136, 2 figs., 1 graph, 1939. [English summary.]

Small bales of chemical and mechanical pulp were subjected to steam of 100° C. for varying periods, the outer portions receiving more intensive treatment than the inner, which, however, retained higher temperatures for a much longer period after the discontinuance of steaming than the outer. Although the temperature in the centre of the bales was

never very high, it was sufficient to kill certain troublesome moulds, e.g., *Pullularia pullulans* [*R.A.M.*, xviii, p. 285] at 47°.

ENGLUND (B.). **Über Pilzschäden in nassem Zellstoff und Holzschliff.** [On fungal damage in wet cellulose and mechanical pulp.]—*Zellstoff u. Papier*, xix, 6, pp. 336, 338, 340, 342, 344, 346, 348, 11 figs., 1939.

This is a comprehensive survey of the problem of fungal infection of pulp [*R.A.M.*, xviii, p. 362] in Finland, among the organisms associated with which are brown rot [unspecified], *Pullularia pullulans*, *Alternaria humicola* [ibid., xvii, pp. 84, 838], and *Rhinocladiella atrovirens* [ibid., xvi, p. 575]. The optimum temperature range for the growth of staining fungi is 20° to 30° C., so that their propagation is practicable in many backwater systems, especially in the summer months. However, the most suitable temperature for manufacturing purposes lies between 35° and 65°, which is beyond the maximum for most of the fungi in question, only two out of 16 being able to withstand a temperature of 50° for 48 hours. Similar results are stated to have been obtained in Norway. Brown rot is exceptional in respect of its temperature relationships, multiplying with great rapidity above 50° and attaining a maximum at 60°, followed by an equally swift decline.

Among the most efficient chemical sterilizers are the chlorophenols dowicide [ibid., xviii, p. 363] and santobrite, and sulphuric acid, the last-named being the most economical, but biological control (by the introduction into the pulp of micro-organisms antagonistic to the pathogens) is considered to afford the best prospect of ultimate success.

RENNERFELT (E.). **Utveckling av svampar i slipmassa av färsk och flottad ved.** [The development of moulds in pulp of fresh and floated wood.]—*Svensk PappTidn.*, xlii, 1, pp. 2–5, 1 graph, 1939.

In laboratory tests to determine the relative susceptibility to fungal infection of floated and green wood (spruce and pine), the development of the yeasts *Rhodotorula glutinis* and *Saccharomyces cerevisiae*, as well as of the 'blueing' organisms, *Cadophora* [*Phialophora*] *fastigiata* [*R.A.M.*, xvii, p. 178] and *Pullularia pullulans* [see preceding abstracts], was much more rapid on the latter than on the former. Moreover, in flasks containing (*a*) glucose alone and (*b*) the same with the addition of green wood or an extract therefrom, the fungi grew much more quickly on (*b*) than on (*a*). The same applies to boards prepared from green wood, which evidently contains substances favourable to mould growth. The increasingly common practice (in Sweden) of mixing fresh with floated wood is therefore to be deprecated, especially where immediate disposal of the pulp cannot be effected.

SCHULZE (B.) & THEDEN (G.). **Polarisationsmikroskopische Untersuchungen über den Abbau des Werkstoffes Holz durch holzzerstörende Pilze.** [Polarization-microscopic studies on the disintegration of timber by wood-destroying fungi.]—*Holz Roh- u. Werkstoff*, i, pp. 548–554, 1938. [Abs. in *Zbl. Bakt.*, Abt. 2, c, 18–23, p. 470, 1939.]

The examination in polarized light of radial, transverse, and tan-

gential sections of wood blocks exposed for definite periods to infection by wood-destroying fungi reveals the progressive disintegration of the cellulose, involving the disappearance of double refraction, while in normal light no significant changes are apparent [cf. *R.A.M.*, xviii, p. 563]. As a rule the advance of the organisms is irregular, severely infected areas alternating at random with completely sound tissues, an observation that explains the prevalent cracking of diseased wood. Early and late wood may be attacked in a different manner by the same fungi, while the latter also vary in their mode of infecting the same wood. *Lentinus squamosus* [*L. lepideus*], for instance, on Scots pine [*Pinus sylvestris*] wood proceeds with great regularity and causes few fissures, whereas *Lenzites abietina* produces intense local infection in some areas and leaves others untouched, leading to extensive cracking.

ALBERTI (K.). **Untersuchungen über das Osmose-Holzschutzverfahren.** [Investigations on the osmosis wood preservation process.]—*Holz Roh- u. Werkstoff*, i, pp. 426–432, 1938. [Abs. in *Zbl. Bakt.*, Abt. 2, c, 18–23, p. 469, 1939.]

Osmolite timber preservatives [cf. *R.A.M.*, xvii, p. 283], consisting of sodium fluoride, dinitrophenol, and arsenic in various proportions, are applied in Germany in paste form at maximum concentrations to newly felled, decorticated logs, which are then stacked in a sheltered place for three to six months. By this time the disinfectant will have penetrated deeply into the wood (heartwood in the case of pine). Osmolite-U and osmolite-U-arsenic form cryolithic compounds in the wood and are thus able to resist lixiviation, to which the ordinary osmolites are liable.

SCHULZE (B.) & THEDEN (G.). **Untersuchungen über die beim 'Klötzchenverfahren' in der Kolleschalen vorhandenen Feuchtigkeitsverhältnisse.** [Investigations on the moisture relations prevailing in Kolle flasks in the 'wood block process'.]—*Holz Roh- u. Werkstoff*, i, pp. 501–502, 1938. [Abs. in *Zbl. Bakt.*, Abt. 2, c, 18–23, pp. 469–470, 1939.]

It was ascertained by means of hygrometric and electrometric computations that an atmospheric humidity of 100 per cent. prevails in the Kolle flasks used for testing timber preservatives by the wood block method for a period of up to five months. The moisture content of the wood blocks at first increases very rapidly, then somewhat more slowly, reaching fibre saturation point in about five days. The further fungal decomposition is advanced, the higher is the moisture content of the wood up to fibre saturation point, beyond which the attacks of the pathogens are impeded by the water filling the wood pores.

SCHULZE (B.). **Umfassende Prüfung von Holzschutzmitteln gegen holzzerstörende Pilze.** [The comprehensive testing of timber preservatives against wood-destroying fungi.]—*Holz Roh- u. Werkstoff*, ii, 3, pp. 99–109, 10 figs., 4 graphs, 1939.

Full directions are given for the testing of timber preservatives for

their toxicity to wood-destroying fungi by the standardized wood block method, as well as for other requisite properties, such as penetrability, physico-chemical stability, and absence of corrosive and fibre-damaging effects [cf. *R.A.M.*, xviii, p. 364].

OLSSON (P. A.). **Klumprotsjuka (Plasmodiophora brassicae Wor.) på Rovor och Kålrötter samt åtgärder mot densamma speciellt ur växtförädlingssynpunkt.** [Club root disease (*Plasmodiophora brassicae* Wor.) of Turnips and Swedes with measures for its control, especially from the plant-breeding standpoint.]—*Sverig. Utsädesfören. Tidskr.*, xlix, 1, pp. 4–76, 16 figs., 1 diag., 1939. [English summary.]

This is an exhaustive survey of the available knowledge concerning club root of crucifers (*Plasmodiophora brassicae*), with special reference to its occurrence in Sweden on turnips and swedes and to the possibilities of control by the development of resistant varieties [*R.A.M.*, xviii, p. 720]. Much of the information here presented has already been published in this *Review*, but the following items may be mentioned. There is a certain resemblance between the club root excrescences and those liable to develop, presumably as a sequel to chromosomal aberrations, in hybrids between turnips, and swedes or other crucifers [ibid., viii, p. 282]; in the latter case, however, there is no tendency to decay. Full details are given of the breeding experiments in progress under the auspices of the Swedish Seed Association since 1929, which have amply demonstrated the difficulties of developing a permanently resistant habit.

No variety of swedes has been found as resistant as May or Immune, though the latter is not really immune and may show up to 50 per cent. of the plants mildly affected. Bortfeld is less resistant than Dale's Hybrid, and Bangholm than the green-topped Swedish type. Neither Herning, a Danish variety, nor Wilhelmsburger (of German origin) seems to be appreciably superior to the common Swedish swede. The turnip Bruce Purple Top (8008) presented a very sound appearance in the field, but only 6 to 7 per cent. of the roots were found to be entirely healthy; however, the high degree of resistance of this variety was demonstrated by the large percentage (up to 83 per cent.) of slightly infected roots.

LE CLERG (E.). **Relative efficiency of quasifactorial and randomized-block designs of experiments concerned with damping-off of Sugar-Beets.**—*Phytopathology*, xxix, 7, pp. 637–641, 1 fig., 1939.

Data obtained from uniformity trials made with sugarbeets against damping-off [*Corticium solani*, *Phoma betae*, and *Pythium de Baryanum*: *R.A.M.*, xvii, p. 153; xviii, p. 566] in the field in two years, and in two trials on two types of plant tables in the greenhouse demonstrated that the quasifactorial design of plot arrangement was more efficient than a randomized block test in some seasons with 36 treatments in the field. With 25 treatments or under, the quasi-factorial design was less efficient in most cases, though more efficient in a few. In the greenhouse tests marked losses in efficiency resulted with the quasi-factorial design as compared with the randomized-block.

DOXTATOR (C. W.). **Results of variety trials by the American Beet Seed Company.**—*Proc. Amer. Soc. Sug. Beet Technol., 1939.* [Abs. in *Facts ab. Sug.*, xxxiv, 8, p. 35, 1939.]

The yields obtained from eight U.S. sugar beet selections grown in (1) leaf spot [*Cercospora beticola*: *R.A.M.*, xviii, p. 721], (2) non-leaf spot, and (3) curly top [ibid., xviii, p. 287] areas of the United States are tabulated.

DE BRUYN (HELENA L. G.). **Mangaangebrek, oorzaak van de kwade harten van Erwten.** [Manganese deficiency as the cause of marsh spot of Peas.]—*Tijdschr. PlZiekt.*, xlv, 3, pp. 106–120, 2 pl., 1939. [English summary.]

Further evidence is adduced from experiments with water and glass sand cultures for the implication of manganese deficiency in the etiology of marsh spot of peas in Holland [*R.A.M.*, xviii, p. 79]. In acid solutions the manganese is more readily available to the plants than in alkaline ones, but even in the former the pathological symptoms developed in the absence of sufficient quantities of the element, showing that the hydrogen-ion concentration of the medium is of secondary importance. The seeds in the later formed pods of individual plants were more severely affected than those produced earlier, when the supplies of available manganese are presumably larger. Under field conditions the highest incidence of marsh spot occurs among the heaviest peas, but in cultures the lightest (under 400 mg.) suffered most (41·5 per cent.) and the heaviest (over 500 mg.) least (19·5 per cent.).

DELWICHE (E. J.), MUSBACH (F. L.), SARLES (W. B.), TRUOG (E.), WALKER (J. C.), & WILSON (H. F.). **Canning Peas in Wisconsin.**—*Bull. Wis. agric. Exp. Sta.* 444, 24 pp., 7 figs., 1939.

This bulletin contains the following information on canning pea diseases. Seed-borne diseases, such as the foliage and pod blights caused by *Ascochyta* [*pisi*], are diminishing in importance now that nearly all Wisconsin planting stock is procured from the arid western States free from these organisms. For the same reason bacterial blight [*Pseudomonas pisi*] is less troublesome than formerly.

Common wilt [*Fusarium orthoceras* var. *pisi*: *R.A.M.*, xviii, p. 81] may be combated by the cultivation of resistant varieties, e.g., the highly popular Alaska, Wisconsin Early Sweet, New-Line Surprise, and Mardelah (early), Ace, Climax, Canner King, Epicure, Early Kay, Gradah, Pride, Wisconsin Penin, Early Wales, Early Perfectah, and Early Perfection (mid-season), and Yellow Admiral, Green Admiral, Major, Wisconsin Merit, Wilt Resistant Perfection, and Prince of Wales (late). The only variety with a moderately high degree of resistance to 'near wilt' [*F. oxysporum* f. 8: ibid., xiv, p. 613] is Rogers K.

Damage from root rot [? *F. solani* var. *martii* f. 2 and *Aphanomyces euteiches*: ibid., xvi, pp. 439, 510] is mainly restricted to rainy seasons and wet soils, for instance, the clays of the east and north-east and the heavy silt loam of the central part of the State. In 1938 drilling fertilizer with the seed substantially reduced the losses from root rot on the last-named soil type, other helpful practices being thorough drainage and tillage before sowing, and crop rotation.

In seed treatment trials [against unspecified rots] in 1936, 1937, and 1938, red copper oxide and ceresan [ibid., xviii, p. 495] were of no benefit during the first two years, but improved the stands of sweet varieties (not Alaska) in the wet season of 1938. Chemical seed treatment has the disadvantage of killing the root nodule bacteria introduced into the seed through inoculation, and is not generally recommended, except possibly for sweet types under damp conditions.

McKay (R.). **Observations on Onion mildew caused by the fungus Peronospora schleideniana W. G. Sm.**—*J. R. hort. Soc.*, lxiv, 6, pp. 272–285, 7 figs., 1939.

In a study on the onion mildew (*Peronospora schleideniana*) [*R.A.M.*, xviii, p. 728] conducted in the Glasnevin Botanical Gardens, Eire, from 1931 to 1938, the part played by oospores in the perpetuation of the disease was investigated. It was found that in some seasons the oospores are produced in enormous numbers, as many as 90 per cent. of the leaves containing them, and up to 1,176 oospores occurring per sq. mm. of leaf surface. Germination was first observed when the oospores were four years old, and after a further five months reached 1 per cent. in oospores placed in water and kept at room temperature for eleven days. The percentage increased to about 2 per cent. in five-year-old spores [cf. ibid., xvi, p. 651]. At the end of seven years the germination amounted to about 5 per cent. in spores kept in water for 48 hours at 20° C., but increased to 95 per cent. after the addition of a potassium permanganate solution (0·01 to 0·02 per cent.) to the spore suspension on slides. A considerable increase, although not quite as high, resulted from the addition of hydrogen peroxide (10 vols. diluted to 1/100 to 1/200). The absolute minimum and maximum temperatures for germination were not ascertained, but in the presence of potassium permanganate five-year-old oospores germinated at temperatures from 2° to 26° inclusive, with the optimum around 20°. These observations indicate that the oospores remain viable for a long period of time, the exact number of years being still unknown.

It is recommended that wherever onion mildew occurs, all foliage should be raked together and burnt, and on no account added to the manure or the compost heap.

Ogilvie (L.), Croxall (H. E.), & Hickman (C. J.). **Progress report on vegetable diseases. X.**—*Rep. agric. hort. Res. Sta. Bristol, 1938*, pp. 91–97, 1 pl., [1939].

In 1938, asparagus rust (*Puccinia asparagi*) [*R.A.M.*, xvii, p. 716; xviii, p. 649] was not observed until 20th August in the vicinity of Evesham, but by 27th September it had spread considerably in two areas in this locality. No early signs of rust appeared in a field where calcium cyanamide had been applied to the soil at the rate of 5 cwt. per acre after the badly infected bower had been cut, though the disease appeared in a neighbouring two-year-old bed. In October and November the rust was observed to be parasitized by *Darluca filum* [ibid., xviii, p. 580], while *Botrytis cinerea* was frequent on the rust lesions in damp weather, and appeared to check its development in some degree [ibid., xvii, p. 429]. As the uredospores of *P. asparagi* remain viable for

two weeks on cut bower, it should be promptly burned. A small percentage of the teleutospores on old pieces of stem are able to germinate from December onwards, date of germination apparently being related with date of formation and weather conditions during winter. Pycnidia and aecidia were induced to develop on forced asparagus shoots in March by suspending pieces of stem bearing teleutospores over them. The spraying of young beds, which carry over the disease from one season to the next, might, it is thought, prove practicable. Attention is drawn to the importance of cutting the bower low down and destroying old stem bases.

Two further cases of asparagus violet root rot [*Helicobasidium purpureum*: ibid., xiv, p. 730] were observed.

The *Fusarium* [ibid., xiii, p. 668] causing wilt of runner beans [*Phaseolus multiflorus*] has now been identified as *F. vasinfectum* var. *lutulatum* [ibid., xiv, p. 72], and that causing foot rot of leeks as *F. culmorum*, both identifications being made by D. L. G. Davies; a new and severe outbreak of the latter disease occurred in the Fladbury district in July.

Early autumn sowings of onions were more severely affected by white rot (*Sclerotium cepivorum*) [ibid., xviii, p. 82] than were late sowings.

NICOLAS (G.) & AGGÉRY [BERTHE]. **Un Septoria nouveau parasite de la Carotte.** [A new *Septoria* parasitic on Carrot.]—*Bull. Soc. mycol. Fr.*, lv, 1, pp. 118–120, 6 figs., 1939.

In August, 1937, carrots in the vicinity of Pierrefitte (Hautes-Pyrénées) showed the presence of spherical or oval pycnidia measuring 150 to 270 μ in diameter, with a circular ostiole 45 to 60 μ in diameter, on both surfaces of the leaves (which were pale green to greenish brown), leaf sheath, and main stem (on which they were isolated or in groups of two). The pycnidia were lined with short, cylindrical, hyaline sterigmata, 7 to 9 by 3·5 to 4·5 μ, bearing filamentous, rectilinear, or slightly curved spores slender at the extremity, finally bicellular, and measuring 48 to 70 by 3 to 4·5 μ. The intercellular mycelium, 2 to 6 μ in diameter, showed globular, terminal, or intercalary swellings 3 to 7 μ in diameter on a very short stalk, and crowned with a ring of small haustoria. The fungus does not appear to be the same as *Septoria daucina* (the description of which is incomplete, but the spores of which measure 25 to 50 by 1 to 2 μ), and is regarded as a new species, which is named *S. dauci*, with a Latin diagnosis.

FLACHS (K.). **Dactylium dendroides Bull. als Gelegenheitsparasit an Champignon.** [*Dactylium dendroides* Bull. as a facultative parasite of the Mushroom.]—*Prakt. Bl. Pflanzenb.*, xvii, 1–2, pp. 6–12, 6 figs., 1939.

Dactylium dendroides is stated to have been responsible for substantial losses in a Munich mushroom [*Psalliota* spp.: *R.A.M.*, xvii, pp. 584, 791] planting at the end of 1938. On malt agar the conidia germinated readily at room temperature and in a few days produced a yellowish aerial mycelium and a dark red colour and alkaline reaction in the substratum. The fungus grew on weakly acid neutral or weakly alkaline media but not on strongly alkaline ones. The optimum, maximum,

and minimum temperatures for growth were approximately 22°, 29°, and 9° C., respectively. Profuse conidial formation occurred at 18°. A description is given of the characters of the fungus and its taxonomy is briefly discussed. The perfect stage (*Hypomyces rosellus*) did not develop, and inoculation experiments with *D. dendroides* gave negative results.

LINN (M. B.). **Dissemination of Celery blight pathogens on the clothing of farm labourers.**—*Phytopathology*, xxix, 6, pp. 553–554, 1939.

Experimental evidence was obtained in corroboration of field observations on Staten Island, New York, to the effect that the spores of early and late blights of celery (*Cercospora apii* and *Septoria apii*) [*R.A.M.*, xviii, p. 722] are carried on the clothing of labourers engaged in operations necessitating proximity to the beds—in the present instance the cutting of spinach, interplanted in paired rows between the celery and gathered during August when the latter crop is advancing towards maturity. The spinach was cut in the early morning, when the plants were wet with dew.

LIN (K. H.). **The number of spores in a pycnidium of Septoria apii.**—*Phytopathology*, xxix, 7, pp. 646–647, 1939.

Examination of 280 samples of celery seed from New York state showed that 142 contained seeds bearing pycnidia of *Septoria apii-graveolentis* [*R.A.M.*, xviii, p. 722]. Counts showed that the number of spores released from one pycnidium amounted to 3,675 (average for nine counts). On severely infected plants an average of 56 pycnidia were present on a lesion. Thus, if only ten primary lesions were present in a seed bed there might be 1,500,000 spores available as secondary inoculum long before transplanting.

MÜLLER (K. O.). **Zur Biologie und Bekämpfung des falschen Mehltaus beim Salat.** [On the biology and control of downy mildew of Lettuce.]—*Kranke Pflanze*, xvi, 6, pp. 110–113, 2 figs., 1939.

Most of the information in this semi-popular note on the biology and control of downy mildew of lettuce (*Bremia lactucae*) [*R.A.M.*, xviii, p. 228] in Germany has already been noticed from other sources [ibid., xviii, p. 7].

PRASAD (N.) & PADWICK (G. W.). **The genus Fusarium II. A species of Fusarium as a cause of wilt of Gram (Cicer arietinum L.).**—*Indian J. agric. Sci.*, ix, 3, pp. 371–380, 1 pl., 1939.

Over 300 isolates of *Fusarium* [*R.A.M.*, xviii, pp. 500, 710] made from wilted plants of gram (*Cicer arietinum*) collected in 1937 and 1938 in Karnal and Delhi, India, were separated into 13 groups according to certain major characteristics. In three lots of infection tests, in which gram seeds were sown in pots with infested sterilized soil, two of the groups appeared to be non-pathogenic, eight caused severe seed rotting, and three caused wilting. On the basis of these results the authors conclude that apart from a wilt of gram due to some physiological disturbance occasioned by soil conditions, as Dastur believed [ibid., xv, p. 423], wilt may certainly be caused by *Fusarium*, as maintained by Narasimhan [ibid., ix, p. 10]. It is also clear that wilted gram plants may harbour an extraordinarily wide range of *Fusarium* types, perhaps

different species, and these are capable of causing two distinct diseases, namely, a seed rot and a wilt. A morphological study of single spore cultures of the three wilt-producing types isolated showed that all three are alike in major characters and belong to the subsection *Orthocera*. Further studies for the identification of these fungi are in progress.

Gottlieb (M.) & Butler (K. D.). **A Pythium root rot of Cucurbits.**—*Phytopathology*, xxix, 7, pp. 624–628, 1 fig., 1939.

Watermelons, Honeydew melons, Quil muskmelons, and Crookneck squash in Arizona were attacked in 1935 and 1936 by a watery root rot which caused heavy losses. The disease was characterized by sudden wilting. The roots of affected plants bore light brown, watery, depressed lesions which ranged in size from 3 mm. in diameter to lesions almost entirely covering the root. In some cases several lesions coalesced to form large, depressed, rotted areas. A few indefinite lesions were observed on the stems, and fruit rot was commonly present. The soil was a poorly drained heavy loam, which remained wet for long periods. Infected material constantly showed the presence of *Pythium aphanidermatum* [*R.A.M.*, xv, p. 587], inoculations with which on watermelons, apples, cantaloupes, carrots, cucumbers, eggplants, grapes, summer squash, sweet potatoes, and tomatoes gave positive results, frequently without wounding. The only cucurbit tested that failed to become infected was *Cucurbita digitata*.

Oospores were produced abundantly both in nature and in culture, but sporangial production was induced only with difficulty. Optimum growth in culture occurred at 37° C., growth being very slight at 45° and nil at 5°. Marked loss in vegetative vigour took place following the original isolations. In 16 months vigour steadily decreased and oogonial formation in culture correspondingly declined, oogonia forming still abundantly, but the number of mature oospores falling considerably. Successive passages of the fungus into Cucurbitaceous fruits increased its vigour, but only temporarily.

Pollacci (G.), Ciferri (R.), & Gallotti (M.). **Il proteinato di rame per uso agricolo.** [The proteinate of copper for agricultural use.]—*Boll. Soc. ital. Biol. sper.*, xiv, 3, pp. 158–159, 1939.

Attention is drawn to the strong fungicidal efficacy, e.g., in the control of vine downy mildew (*Peronospora*) [*Plasmopara viticola*], of a mixture of lysalbinate and protalbinate of sodium with colloidal copper hydrate, producing the double salts of sodium and copper. The resultant blends are stable, economical, easily prepared, of high penetrative capacity, and able to liberate metallic copper in the colloidal state.

Seeliger (R.). **Beobachtungen über das Auftreten der Perithezien des echten Mehltaues der Rebe.** [Observations on the development of the perithecia of the true mildew of the Vine.]—*Arb. biol. Anst.* (*Reichsanst.*) *Berl.*, xxii, 4, pp. 453–478, 2 diags., 1939.

In 1935 the perithecia of true mildew of the vine (*Uncinula necator*) were found in very large numbers from mid-September onwards on greenhouse vines at the Naumburg (Saale) branch of the Biological

Institute, whereas in 1936 they were produced sparsely on two stocks only. Environmental factors were presumably responsible for the differences in the development of the pathogen in the two seasons. In 1935 the mean local temperatures from April to September and June to September were 3·5° and 4·6° C., respectively, above the normal, and the duration of sunshine during the same periods 102·3 and 106·4 hours, respectively, longer than the average, the corresponding figures for the same periods in 1936 being +0·7° and +1·5° and −93·6 and −24·9 hours, respectively. The adverse temperature and sunshine relations of the latter year were not counterbalanced by the rainfall deficit, precipitation during the two observation periods being −70 and −64·6 mm., respectively, as against −30·4 and −11·5 mm., respectively, in 1935. Moreover, assuming that Laibach's observations on the Erysiphaceae [*R.A.M.*, ix, p. 548] are applicable to *U. necator*, the soil dryness induced by the exceptionally warm and rainless summer of 1934 is likely to have persisted through 1935 and further stimulated perithecial formation.

All the vine varieties tested were more or less liable to infection by true mildew, *V*[*itis*] *lincecomii* being among the most resistant and the *vinifera* varieties Blue Portuguese, Grey Silvaner, and Blue Trollinger highly susceptible. The fact that perithecial production varied greatly in abundance on vines in different houses or in the several parts of the same house is attributed to ecological divergences in the individual habitat rather than to any inherent tendency on the part of the pathogen to fruit less freely on some varieties than on others, irrespective of the incidence of infection. A distinct correlation was observed between the severity of mildew and perithecial development, average infection ratings of 1·3, 2, 3, 3·9, and 4·3 in the customary 0 to 5 scale corresponding to the production of fructifications on 20, 60, 67, 93, and 100 per cent., respectively, of the total number of stocks. There was also a connexion between earliness of infection and intensity of perithecial formation, very late (1·6), late (2·6), medium (2·9), early (3·1), and very early (3·4) varieties showing 40, 44, 73, 100, and 100 per cent., respectively, of stocks bearing the fruit bodies of the fungus. Generally speaking, therefore, susceptible varieties tend to contract the disease early and resistant ones late.

BILLEAU (A.). **Cercetari asupra metodelor de observarea desvoltării oosporilor mildiului.** [Research on the methods of observation of the development of oospores of mildew.]—*Anal. Inst. Cerc. agron. Român.*, x (*1938*), pp. 458–463, 5 figs., 1939.

For studying the germination of the oospores of *Plasmopara viticola* in Rumania [*R.A.M.*, xviii, p. 232], the author devised an apparatus consisting of two glass funnels connected by a horizontal tube embedded in the soil about 8 to 10 cm. below the surface. Into one was placed a wad of asbestos and then clean sand, on the surface of which was spread crushed leaves bearing oospores, while the other (with the top 2 cm. lower than the first) was filled with rain water. Observations made with this apparatus during the years 1935 to 1937 showed that the oospores were able to germinate on the surface of the sand provided it was almost saturated with water.

Williams (P. H.), Oyler (Enid), White (H. L.), Ainsworth (G. C.), & Read (W. H.). **Plant diseases.**—*Rep. exp. Res. Sta. Cheshunt, 1938*, pp. 39–63, 1939.

In investigations at Cheshunt in 1938 [cf. *R.A.M.*, xvii, p. 583] cucumbers were found by P. H. Williams to be affected by foot rot due to *Rhizoctonia* [*Corticium*] *solani*, a new host record for England.

In further investigations into *Verticillium* wilt of chrysanthemums [ibid., xvii, p. 584], Miss Oyler inoculated the stems of four Rose Précoce and four Conqueror plants at soil-level with a pure culture of the fungus. After one month, one plant of Rose Précoce was dead, the lower leaves of the other seven had been killed, and the top ones showed yellow patches. The symptoms were more severe on Rose Précoce than Conqueror. Isolations from the discoloured stems, even from the tips of the shoots, and from the petioles of all four plants of Rose Précoce all gave *Verticillium*. When chrysanthemum plants were inoculated above soil-level with the *Verticillium* from chrysanthemum, *V. albo-atrum* from tomato and rose, and *V. dahliae*, the lower leaves of the plants inoculated with the first-named died after one month, and the top leaves showed yellow blotches. The plants inoculated with *V. albo-atrum* from tomato showed less severe symptoms. Three months after inoculation, the chrysanthemum strain was reisolated from wood along the entire length of the plants and *V. albo-atrum* up to a distance of 5 cm. above the point of inoculation. Attempts to isolate the other two inoculants were unsuccessful. Other inoculations with the chrysanthemum strain gave positive results on potato, *Antirrhinum*, aster [*Callistephus chinensis*], *Solanum capsicastrum*, stock, sweet pea, and tomato.

Isolations from Ophelia rose petals showing brown, necrotic lesions, 2 to 3 mm. in diameter, with a dark margin, the petals being crinkled round the spots, gave pure cultures of *Botrytis cinerea*, the agent of 'petal fire' [ibid., xvii, p. 248]. Experimental inoculations by spraying or dusting with the spores gave positive results on Lady Sylvia, Richmond, Roselandia, and Talisman roses.

Infection of carnations by anther smut [*Ustilago violacea*: ibid., xvi, p. 726] was secured by placing drops of a spore suspension on the surface exposed when 'stopping' first-year plants. Apparently, when a spore falls on the cut ends of stems left when 'stopping', the plant later develops infected shoots on one side and clean ones on the other. Infection was not obtained through unbroken surfaces, the exposed surface of an old plant, or through roots. The disease was virtually eliminated in one nursery by the use of clean cuttings, without soil treatment, though 70 per cent. of the previous crop had been smutted.

G. C. Ainsworth states that tomato mixed-virus streak [ibid., xviii, p. 484] was more prevalent than in any previous year. The potato virus components were all moderately virulent strains of potato virus X. The green fruits generally showed raised markings, whereas the fruit lesions in single-virus streak are depressed.

Winter tomatoes were attacked by fern leaf due to cucumber virus 1 [ibid., xvii, pp. 78, 354]. This virus is rare locally on glasshouse tomatoes, though prevalent on vegetable marrows and outdoor plants.

In one aberrant case of spotted wilt unripe tomatoes showed

conspicuous markings, though the leaf symptoms were very slight, the plants having been 'stopped', probably about the time when infection occurred. In a second case, leaf-bronzing was associated with brown streaks on the stem and leaf stalks, though only the spotted wilt virus was present.

Gladiolus plants were affected by mosaic, probably the same as that observed in America in 1928 [ibid., vii, p. 516].

Exmouth Crimson chrysanthemums showed a green (occasionally yellow) mottle of the upper leaves due to a strain of cucumber virus 1 that caused much greater distortion in *Nicotiana glutinosa* than the type virus. Cucumber virus 1 was also obtained from lupin, asparagus kale [? *Brassica oleracea* var. *botrytis*], and sweet pea, the last two being new hosts for England.

Garden and sweet peas were affected by lettuce mosaic virus [ibid., xviii, p. 649], which produced streak symptoms on the sweet peas.

Enation pea mosaic [ibid., xviii, p. 150] and common pea mosaic [ibid., xvi, p. 583] were frequently observed. In sweet peas the former is characterized by a yellow flecking of the leaves and the presence of enations on the under surfaces of the leaves; similar enations are found on garden pea and broad bean [*Vicia faba*]. Common pea mosaic (a group of diseases caused by strains of one virus) attacks garden pea, sweet pea, broad bean, and red clover [*Trifolium pratense*]. The strain of common pea mosaic usually observed caused a faint mottle in sweet pea leaves and breaking in the coloured flowers.

W. H. Read states that a copper-zinc silicate (25 per cent. copper and 4 per cent. zinc), used at 0·2 per cent. in combination with a petroleum emulsion, gave good control of tomato leaf mould (*Cladosporium fulvum*) without noticeable leaf- or fruit-marking, but on rose leaves caused rather more marking than copper oxychloride-oil emulsion mixture.

HOPKINS (J. C. F.). **Report of the Branch of Plant Pathology for the year ending 31st December, 1938.**—*Rhod. agric. J.*, xxxvi, 8, pp. 589–597, 1939.

In this report on plant disease work in Southern Rhodesia in 1938 it is stated that the chief apple diseases found locally are mildew [*Podosphaera leucotricha*: *R.A.M.*, xvii, p. 45], fruit cracking (not always associated with *Coniothecium chomatosporum*) [loc. cit.], and canker (*Botryosphaeria ribis* [var.] *chromogena*) [ibid., xvii, p. 755]. The last-named fungus causes extensive damage to avocado and guava trees, and cross-inoculations from apple and avocado branches to apple and avocado fruits gave positive results.

A preliminary survey of fungi causing breakdown in stored apples showed the prevalence of bitter rot (*Glomerella cingulata*) [ibid., xvii, p. 45] and canker rot (*B. ribis* var. *chromogena*), the latter of which produced an unpleasant wet breakdown rendering numerous samples unsaleable. Examination of many apple trees in various districts showed a high percentage of canker on the branches and trunks. Boxes of apples kept in commercial cold storage for six months showed between 25 and 40 per cent. breakdown due to *Penicillium expansum* [ibid., xviii, p. 441].

Tobacco wildfire (*Bacterium tabacum*) [ibid., xviii, p. 483] caused

heavy loss on some farms, but where control measures were promptly applied was kept within bounds. Field spraying from knapsack sprayers, the most convenient form of application so far tested locally, gave very successful results. Outbreaks increased considerably during the year, many being traced to planting on infected 'second-year' land, or to planting in lands adjacent to those which had carried a diseased crop the year before.

Tobacco was also affected by black stem rot, due apparently to *Pythium aphanidermatum* [ibid., xvii, pp. 163, 295], which killed many young plants put out under unfavourable conditions. In a few instances replanting of entire lands became necessary. In seed-beds it caused persistent damping-off in wet weather, which was controlled by sprinkling the affected patches with dry Bordeaux powder or watering them with Cheshunt compound.

New records for the Colony included *Alternaria mali* on apple [ibid., xviii, p. 38], *Phoma destructiva* [ibid., xvii, p. 139; xviii, p. 726] and *A. solani* [ibid., xviii, p. 66] on tomatoes, and *Coniophora cerebella* [*C. puteana*: ibid., xviii, p. 425] causing dry rot of timber.

Botany and plant pathology.—*Rep. Ohio agric. Exp. Sta., 1936–7* (*Bull.* 592), pp. 34–40, 1938. [Received August, 1939.]

In this report [cf. *R.A.M.*, xvii, p. 446] H. C. Young and H. F. Winter state that in several years' investigations into apple measles [ibid., xvii, p. 755] grafting and budding from diseased to healthy trees and injections of juice from diseased and healthy trees gave only negative results. In further studies seven series each of four Red Delicious apple trees were grown for two seasons in Shive's complete nutrient R_3S_3, one-half atmosphere concentration, in purified sand cultures. Series 1 received the nutrient solution, and the other six were given in addition 1 and 2 parts per million of boron, zinc, and manganese, respectively. During the first season the boron series made about twice the growth of the others. After the first 30 days of the second season pimples appeared on those trees which had not received boron, the inner bark showing a necrotic condition typical of measles. When boron was applied to these affected trees recovery resulted.

In extensive spraying tests in a commercial orchard liquid and dry lime-sulphur, and combinations of lime-sulphur, one-half strength, plus 5 lb. of dusting sulphur or wettable sulphurs per 100 gals. of spray gave fair control of cherry leaf spot [*Coccomyces hiemalis*: ibid., xviii, p. 691] only up to harvest time, while Bordeaux mixture (4–6–100) gave excellent control, but caused severe injury and leaf drop. Cupro-K, Grasselli copper oxychloride, and coposil gave nearly perfect control with very little injury, and that only with the first application.

In a comparative spraying test with a cheap home-made wettable sulphur and a more expensive commercial brand against peach scab [*Cladosporium carpophilum*: ibid., xvii, p. 256] and brown rot [*Sclerotinia fructicola*: loc. cit.], the former material consisting of 8 lb. of dusting sulphur, 4 oz. of dried skim milk, and $\frac{1}{2}$ oz. of aresklene [ibid., xviii, p. 440], mixed dry and added to the tank at the rate of 8 lb. per 100 gals. of water (the commercial product being used at the same strength), one application of either material made three weeks after calyx-fall

kept infection (by both diseases) down to an average of 1·5 per cent. on fruits of the Greensboro, Elberta, and Lemon Free varieties. The unsprayed controls averaged 95 per cent. fruit infection. The preharvest spray was very important against brown rot, but had no effect on scab.

Perfect control of peach leaf curl [*Taphrina deformans*] resulted when lime-sulphur at the recommended strength was applied by a steam vapour sprayer [ibid., xvii, p. 446], the apparatus also giving better results than the ordinary type of sprayer when used against apple scab [*Venturia inaequalis*] and cherry leaf spot, sulphur and lime combinations with gelatine giving excellent control of all three diseases with this apparatus. Adequate coverage resulted with one-third the usual amount of spray and water, though the saving so effected was offset by the cost of fuel. The future of the steam sprayer depends largely on evolving a machine which will apply the spray more rapidly.

P. E. Tilford and H. C. Young found that asphaltum paint was the best tree wound dressing tested in respect of rate of healing and prevention of rots.

In a test for the control of damping-off [*Pythium de Baryanum*, *Corticium solani*, and other fungi: ibid., xviii, p. 561] of red pine [*Pinus resinosa*] seedlings, Tilford found that plots receiving $\frac{1}{8}$, $\frac{1}{4}$, and $\frac{3}{8}$ oz. of formalin per sq. ft. three days before seeding in 1936 had, respectively, 24·7, 39·3, and 55·3 per cent. more seedlings in 1937 than the control plots. After emergence no serious infection occurred.

A block of Corsican pines [*P. nigra* var. *calabrica*], which had shown severe needle blight (probably due to a species of *Septoria*) [? *acicola*: ibid., xviii, p. 360], was sprayed six times with Bordeaux mixture (4–6–50 and 4–4–50, with casein and Grasselli spreader), Bordeaux spray made from powder, cupro-K with Grasselli spreader, palustrex [ibid., xv, p. 781], and dry lime-sulphur mixtures (4 lb. per 50 gals.) with gelatine and Grasselli spreader. The copper sprays were about equally effective and as a group were slightly better than the lime-sulphur mixtures. The average percentages of infected needles at the end of the season on the lower branches of the copper- and lime-sulphur-sprayed trees were 8·9 and 11·1 per cent., respectively, as compared with 28 per cent. for the unsprayed. Plots given only two applications (in July and August) showed 10 per cent. infection on the lower needles. Infection evidently occurred late in the season.

R. C. Thomas refers to the presence of the bacteriophage in lucerne stands which have run out or seem to be declining, and states that where it occurs nodule formation is greatly reduced or lacking [ibid., xv, p. 659]. Lucerne seedings three years old or more and new seedings in old, unproductive fields almost always have the lytic factor present. The association of the bacteriophage with so many cases of lucerne failure would scarcely appear to be merely incidental.

The bacteriophage can be used to identify species of bacterial plant pathogens and to differentiate strains. Using a bacteriophage specific for *Erwinia amylovora*, identifications were made of isolations from pear, apple, mountain ash [*Pyrus* (?) *americana*], *Cotoneaster*, and hawthorn [*Crataegus* sp.]. By using lytic principles specific for two strains of *Aplanobacter stewarti* [ibid., xviii, p. 173] the strains would be rapidly

differentiated. The use of a bacteriophage associated with lucerne failure makes it possible to select commercial cultures [of *Pseudomonas radicicola*] resistant to the bacteriophage for seed inoculation.

Sixty-first Annual Report of the North Carolina Agricultural Experiment Station for the fiscal year ending June 30, 1938. Progress report for year ending December 1, 1938.—83 pp., 7 figs., 1 graph, 1939.

The following items of phytopathological interest occur in this report. R. F. Poole states that following heavy rains during the early part of the season, black shank of tobacco (*Phytophthora* [*parasitica* var.] *nicotianae* [*R.A.M.*, xvi, p. 841]) assumed a severe form over a wide area of Forsyth county in 1938. The residual effects of sulphur on the control of the disease were much less pronounced in 1938 than in 1937, under 10 per cent. of the plants receiving up to 800 lb. per acre reaching maturity.

In a test in February, 1937, the losses from *Bacterium solanacearum* in tobacco plots treated with 800, 1,000, and 1,500 lb. each of sulphur and lime were 26·6, 11·3, and 0 per cent., respectively, but the plants receiving the maximum quantity were badly stunted. In order to overcome the nitrogen deficiency liable to develop on soils given the combined lime and sulphur treatment, cottonseed meal was applied to the soil in April at 500 and 1,000 lb. per acre with beneficial results. In plots treated with copper sulphate at 500 and 1,000 lb. per acre the losses from *Bact. solanacearum* amounted to 69·9 and 21·6 per cent., respectively.

The tobacco mosaic virus was found by S. G. Lehman to be more rapidly inactivated in acid than in alkaline soils, while high soil temperatures also accelerate the process.

The same author enumerates the following as the most frequent seed-borne pathogens of cotton: *Glomerella gossypii*, *Fusarium moniliforme* [*Gibberella fujikuroi*: ibid., xviii, p. 520], *F.* sp., *Pythium*, and *Rhizoctonia* [*Corticium solani*], the two first-named predominating on seedlings from untreated seed not over one year old, the two last on those from treated or older seed, and *F.* sp. being common on both. Of the various chemicals tested for the control of seed-borne fungi, new improved ceresan was the most effective, while promising results were also given by ceresan, cuprocide [ibid., xviii, p. 440], barbak C, sanoseed [ibid., xvii, p. 378], and sterocide; in one experiment the increases from seed treatment with ceresan and sanoseed were 45·8 and 39·8 per cent., respectively. Ceresan also proved very efficacious in the control of sore shin [*C. solani*], which was more prevalent on one-year-old than on two-year-old seed. The same preparation greatly reduced the incidence of *Bact. malvacearum* on the cotyledons.

In an experiment conducted by P. H. Kime and O. P. Owens on Norfolk sand in Richmond county, muriate of potash was applied at the rate of 800 lb. per acre of 6–8–0, 6–8–4, and 6–8–8 for the control of cotton wilt (*F.*) [*vasinfectum*: ibid., xviii, p. 452], which had been present in the soil for several years. Of the twelve varieties included in the test, only Sea Island 13B3 showed no infection, other reputedly resistant types contracting from 13 to 35 per cent. wilt, while two susceptible ones developed 76 and 78 per cent. In the absence of potash even highly resistant varieties were considerably affected.

In inoculation tests by R. F. Poole on sterilized shelled groundnuts with various fungi isolated from root-rotted groundnut plants, *F. vasinfectum*, *G. fujikuroi*, and a number of unidentified *F.* spp. were parasitic to the nuts and other parts of the seedling plants under favourable conditions. *Sclerotium bataticola* [*Macrophomina phaseoli*] was pathogenic at 28° C., but not at 18°; one strain of *C. vagum* [*C. solani*] attacked the nuts at 28° only, another at and below 18°, while *S. rolfsii* [ibid., xv, p. 278], isolated from a single source, is probably perpetuated more extensively through the soil than by way of the seed.

Promising results in the control of *Bact. pruni* on peach were obtained in R. F. Poole's experiments in the heavy application (1,400 to 2,000 lb. per acre) of combined potassium and magnesium sulphates.

R. Schmidt's investigations on the development of tomatoes for resistance to wilt [*F. bulbigenum* var. *lycopersici*: ibid., xviii, p. 766] have conclusively demonstrated the value of Louisiana Pink [ibid., xviii, p. 439] in this respect, while Scarlet Dawn is susceptible.

Plant Pathology Department.—*Rep. Fla agric. Exp. Sta., 1937–38*, pp. 109–128, 3 figs. [1939].

This report contains, among others, the following items of interest [cf. *R.A.M.*, xv, p. 780]. Studies by A. H. Eddins showed that three seed stocks of Irish potatoes showing, respectively, a trace, 5 per cent., and 28 per cent. plants affected with bacterial wilt and soft rot [*Bacterium sepedonicum*: ibid., xviii, p. 758] in Maine fields developed, respectively, 12·2, 25, and 63·9 per cent. diseased plants when planted at Hastings, Florida. Seed pieces from diseased tubers decayed completely or gave wilted plants and infected tubers. Seed pieces cut from healthy tubers with a knife previously used to cut affected ones gave plants 70 per cent. of which bore diseased tubers.

When one lot of Spaulding Rose potatoes of which 37 per cent. showed net necrosis [ibid., xviii, p. 409] was divided into affected and unaffected tubers, the latter gave 44·7 per cent. and the former 84·2 per cent. leaf roll plants, with 40 per cent. less yield from the affected than from the unaffected tubers.

Chippewa potatoes grown in Scranton fine sand treated with 800 lb. sulphur and 3,000 lb. limestone per acre in 1934 showed only 0·05 per cent. brown rot (*Bact. solanacearum*) [ibid., xviii, p. 473] in 1938, as against 1·5 per cent. infection in adjacent untreated plots. The treatment increased the yield by 5·6 barrels per acre. Similar treatment of Bladen fine sandy loam in 1935 also gave excellent control in 1938, with only 0·2 per cent. tubers affected (Spaulding Rose variety), as against 25·4 per cent. in the adjacent controls, and an increased yield of 27·1 barrels per acre. In soils of P_H 5, 5·5, 6, 6·5, the amounts of sulphur required to effect control are 650, 900, 1,150, and 1,400 lb. per acre, respectively. The best control and yield were obtained when 1 ton of limestone per acre was applied five months after the sulphur.

A comparative study by R. K. Voorhees of strains of *Diplodia* resembling *D. frumenti* [ibid., xvii, p. 670] on maize and obtained from various economic hosts in Florida and other tropical regions showed them to be physiologic forms of one species, such species as *D. frumenti*,

D. natalensis, *D. tubericola*, *D. cacaoicola*, *Botryodiplodia theobromae*, and others all being thought to be synonymous.

In tests by A. S. Rhoads *Clitocybe tabescens* [ibid., xiv, 564] grew at all temperatures between 12·3° and 35·8° C., but not at 40·1°; it made best and about equally good growth at 24·7°, 29°, and 31·6°. *Armillaria mellea* made best growth at 21·7° and 24·7° and very slight growth at 35·8°. *C. tabescens* made about equally good growth on potato dextrose maltose agar at all P_H values tested from 3·9 to 8·7, except that on the alkaline side of the range less sporophore development occurred. *A. mellea* grew equally well at all reactions from P_H 3·9 through 6·3, but produced a progressively decreasing amount of growth beginning with P_H 7·0. Artificial infection of two large Australian pines (*Casuarina lepidophloia*) was obtained with *Clitocybe tabescens* by wiring pieces of infected roots of *Casuarina equisetifolia* in contact with uninjured roots. This is the first occasion that this disease has been transmitted artificially from affected to healthy trees. During the year *Clitocybe tabescens* were isolated from three new hosts, making a total of 139 different species found infected in Florida.

A. N. Brooks found that during winter and early spring mature ascospores of celery pink rot (*Sclerotinia sclerotiorum*) [ibid., xv, p. 768; xvii, p. 588] remained viable *in vitro* and under different light intensities for 20 to 63 days. Inoculation tests indicated that the ascospores are unable to infect uninjured tissue. Deep ploughing, by burying most of the sclerotia, greatly reduces the number of apothecia developing in the field during the growing period of the crop, while flooding kills the sclerotia. In field treatments the only plots not showing apothecia were those given calcium cyanamide applied dry at rates of 2,000, 4,000, and 8,000 lb. per acre after harvest. These plots at first remained healthy, but infection gradually spread to them from the others, and at harvest time they showed as much disease as the untreated controls.

A. S. Rhoads states that in May, 1935, patches of bark from an orange limb affected by psorosis [ibid., xviii, p. 518] were grafted into the upper limbs of five large healthy orange trees, and in June, 1938, six inoculated limbs on three trees had developed symptoms varying from initial scaling of the bark to well-defined lesions. This indicates that the disease belongs to the virus group.

Grieve (B. J.). **Epinastic response induced in plants by Bacterium solanacearum E.F.S.**—*Ann. Bot., Lond.*, N.S., iii, 11, pp. 587–600, 1 pl., 1 fig., 1939.

In further studies carried out in Melbourne evidence was obtained that the epinastic response in leaves of potato, tomato, castor oil (*Ricinus communis*), and African marigold (*Tagetes erecta*) plants invaded by *Bacterium solanacearum* [*R.A.M.* xvii, p. 302] is an irreversible growth reaction. No constant relation was established between the number of bacteria present at or near the reactive zone or the degree of penetration into the leaf trace bundle and the initiation of the condition. The growth reaction was governed by the plant variety, size of the plant, environmental conditions, and relation of the plant to gravity. No evidence was forthcoming that bacterially induced

epinasty in potato plants is rendered less effective by the neutralization or co-operation of gravity, whereas inverted tomato plants showed no such epinastic reaction. Proof was obtained that epinastic response is not due to mechanical blocking of the vessels by bacteria, ammonia production and P_H effects in the vessels, or toxin production. Hetero-auxin is produced in culture media in amounts sufficient to induce epinasty in tomato leaves, but so far it has not been detected in invaded vessels.

NÁBĚLEK (V.). **Apfelduft fördert Pflanzenkrebs.** [Apple aroma promotes crown gall of plants.]—*Z. Krebsforsch.*, xlviii, 5, pp. 391–399, 8 figs., 1939.

In experiments at the Pressburg (Bratislava) Biological Institute, Czechoslovakia, in which sunflower seedlings inoculated with *Bac*[*terium*] *tumefaciens* were grown under bell-jars in the presence of a fresh green Jonathan apple, the aroma emanating from the fruit immediately arrested the ontogenetic growth of the plants while simultaneously stimulating that of the bacterial tumours to dimensions eight to ten times exceeding those on similarly infected seedlings without apples. It is apparent from their divergent responses to the same stimulus that autonomous crown gall development and normal individual growth are of a fundamentally different order.

ABE (T.) & MATSUMURA (S.). **On the susceptibility of back-crossed offspring of pentaploid Wheat hybrids to Puccinia triticina.**—*Proc. Soc. Crop Sci. Japan*, x, pp. 71–84, 1938. [Japanese. Abs. in *Jap. J. Bot.*, ix, 4, pp. (145)–(146), 1939.]

The authors describe their observations in Japan on the reaction of the back-crossed progeny of pentaploid wheat hybrids to *Puccinia triticina* [*R.A.M.*, xvi, p. 238], which showed that in 1936 *Triticum polonicum* var. *vestita* and *T. durum* var. *reichenbachii* (both representatives of the emmer group, $2n = 28$) suffered little or no damage in the field from the disease, whereas the dinkel (common) *T. vulgare* var. *erythrospermum* and *T. spelta* var. *duhamelianum* ($2n = 44$) were severely attacked. The reciprocal F_1 hybrids between (1) *T. polonicum* var. *vestita* and *T. spelta* var. *duhamelianum* and (2) *T. durum* var. *reichenbachii* and *T. vulgare* var. *erythrospermum* proved to be fairly susceptible to the rust, resembling in this respect the common rather than the emmer parents. In 1937 inoculation experiments on the back-crossed seedlings *T. polonicum* var. *vestita*$\times F_1$ and *T. durum* var. *reichenbachii*$\times F_1$ and reciprocally ($2n = 28$ to 35) substantiated the connexion between a high chromosome number and susceptibility to *P. triticina*, the correlation coefficient being $r = +0{\cdot}4021 \pm 0{\cdot}0504$. In all cases the increase in the chromosome number originated in the D-genom derived from common wheat, which is evidently the chief, though probably not the sole, carrier of susceptibility. On the other hand, there was no marked increase in the susceptibility of the back crosses *T. vulgare* var. *erythrospermum*$\times F_1$ and *T. spelta* var. *duhamelianum*$\times F_1$ and reciprocally, which are similarly liable to the rust, parallel with an increase in the chromosome number ($r = +0{\cdot}651 \pm 0{\cdot}0467$).

Parker-Rhodes (A. F.). **Investigations on certain toxic substances obtained from the Wheat plant which inhibit the germination of the uredospores of various Wheat rusts.**—*J. agric. Sci.*, xxix, 3, pp. 399–417, 6 graphs, 1939.

Substances capable of inhibiting or reducing the germination of the uredospores of *Puccinia glumarum* and *P. triticina* were obtained from wheat plants by grinding up healthy leaves with water, boiling the pulp for a few minutes, centrifuging at about 1,000 r.p.m. for a few minutes, and then decanting the clear green supernatant solution. Plants of Little Joss lost their resistance to *P. triticina* when infected with *Tilletia caries*, and a solution from such plants was less toxic to the rust than that from healthy ones of the same variety. On the other hand, healthy plants of the variety Vulgare P.P. yielded a more toxic solution than Kanred, though the latter is more resistant, and no correlation was observed in four other varieties of wheat tested. When, however, the solutions were prepared by a method reducing enzyme activity during preparation to a minimum (namely, from leaves dried in an oven at 95° C., water being added at the rate of 40·5 parts by weight to one part of dry leaf tissue), it was found that these were non-toxic when obtained from healthy living leaves, possibly toxic when derived from decaying ones, and toxic when originating in rusted material. In the last case a greater toxin production was observed in plants supplied with excess of potassium or those deficient in boron, copper, zinc, and manganese. Toxic substances produced in leaves infected with *P. glumarum* were toxic only to spores of that species and not to those of *P. triticina*, and vice versa. It is suggested that these specific toxins are either antibodies analogous to those known from animal pathology, normal constituents of the rust hyphae, or staling products, and that they are distinct from the non-specific toxins obtained by the method first described from triturated healthy or decayed leaves, which may possibly be the product of the autolytic activity of enzymes.

Millikan (C. R.). **The influence of nutrition on the reaction of Wheat to Urocystis tritici Koern.**—*J. Dep. Agric. Vict.*, xxxvii, 6, pp. 302–308, 1 fig., 1 graph, 1939.

In sand culture trials conducted at Burnley, Victoria, in 1936, calcium deficiency was found to inhibit completely the development of flag smut (*Urocystis tritici*) [*R.A.M.*, xviii, p. 656] in the susceptible Free Gallipoli wheat variety, nitrogen and potassium deficiencies both tended to decrease the severity of the disease, and phosphorus and magnesium deficiencies to increase it. In experiments on the same variety in 1937 confirmation was obtained of the effects of deficiencies of calcium, potassium, magnesium, and phosphorus, though calcium deficiency permitted some infection; the increase resulting from phosphorus deficiency was very significant, whilst nitrogen deficiency was not tested, and calcium excess increased infection. In tests in 1937 with the resistant variety Ghurka excess calcium again increased infection, but the results with deficiencies of calcium, phosphorus, potassium, and magnesium were not significant. In 1938 further

confirmatory evidence of the effect of calcium deficiency and excess in reducing and increasing the severity of flag smut was obtained on Free Gallipoli. The results of chemical analyses of the experimental plants of this variety showed that an optimum concentration of calcium for the development of flag smut obtains, above and below which the severity of infection increased. In the Ghurka variety the relationship was less clearly defined. No relationship was detected with the other constituents.

RUSSELL (R. C.). **Pathogenicity tests with cultures of Ophiobolus graminis Sacc.**—*Sci. Agric.*, xix, 11, pp. 662–669, 1 fig., 1 graph, 1939.

Further tests (carried out from 1937 to 1939) are described on the relative pathogenicity to wheat of eight isolates of *Ophiobolus graminis* used in similar experiments in 1934 [*R.A.M.*, xiii, p. 502]. Of these, five from Saskatchewan had been growing in culture for 9 to 14 years (by 1939), while one from Australia and two from the United States had probably been kept in pure culture for over 15 years. Wheat seedlings in sterilized soil in crocks in the greenhouse were inoculated and a disease rating was arrived at based on the amount of stunting and lesions produced. The results showed that the pathogenicity of most of the isolates continued to fluctuate since 1934. For instance, isolate 1 was moderately pathogenic in 1934, only slightly so in 1937, 1938, and January, 1939, and moderately so again in March, 1939. During the same period the pathogenicity of isolate 2 fell from severe to slight and rose again to moderate. The pathogenicity of isolate 3 remained slight, whereas that of isolate 4 fell from severe to slight. Isolate 6 was slightly pathogenic in 1934, moderately so in 1937, severely so in 1938, and again moderately pathogenic in 1939. Isolates 10, 11, and 31 all fluctuated, but were all moderately pathogenic in 1939, after over 15 years in culture.

In experiments with isolates 2 and 4 to elucidate the reason for the fluctuations in pathogenicity, neither differences in temperature nor repeated passage through the host exercised any consistent effect on the pathogenicity of either. Cultures of isolate 4 uniformly showed a reduction in pathogenicity since 1936, although kept under different environmental conditions. It would appear that the loss in pathogenicity shown by various cultures of *O. graminis* after long periods in artificial culture was due to some factor operating independently of temperature and unaffected by repeated passages of the culture through the host.

OORT (A. J. P.). **Inoculation experiments with loose smuts of Wheat and Barley (Ustilago tritici and U. nuda).**—*Phytopathology*, xxix, 8, pp. 717–728, 2 figs., 2 graphs, 1939.

A full description is given of the author's experiments at the Mycological Laboratory, Wageningen, Holland, in the inoculation of Vilmorin 27 wheat and Vogel's Agaer and Vindicat 14 barley with loose smuts (*Ustilago tritici* and *U. nuda*, respectively), using an adaptation of M. B. Moore's technique [*R.A.M.*, xv, p. 567] involving the enclosure in the inoculating chamber of four heads instead of one. By this means, two persons can deal in one hour with 80 wheat and 50 barley heads,

representing a substantial increase over the numbers that can be treated in a corresponding period by the Halle method, entailing the inoculation of each individual flower with dry spores, as described by Roemer *et al.* [ibid., xvii, p. 476].

The loss of inoculated plants at emergence and during the winter was relatively slight, amounting to only 10 and under 20 per cent. for wheat and barley, respectively. In all the tests partially diseased plants were observed (3·9 per cent. wheat and 3·8 barley), the majority being more than half infected. In wheat healthy and entirely diseased heads developed in the same plant, whereas in barley semi-infected heads were more prevalent. The optimum period for inoculation lasts only a few days during antithesis. The spore inoculum exerts its maximum effect on wheat and barley at concentrations of 1 and 0·1 gm. per l. water, respectively, but a fairly high degree of infection is obtainable at 0·001 gm. per l. (10 spores per cu. mm.). By increasing the number of vacuum pump strokes, whereby the air between the glumes is replaced by a spore suspension, from two to ten, the incidence of infection by *U. tritici* on wheat was increased from 55 to 83 per cent.

FORBES (I. L.). **Factors affecting the development of Puccinia coronata in Louisiana.**—*Phytopathology*, xxix, 8, pp. 659–684, 1939.

In laboratory experiments uredospores of crown rust of oats (*Puccinia coronata*) stored at —18° and 33° C. rapidly lost their germinability, which also did not persist for any length of time at 4°, 15°, and 20°, whereas at 10° 8 per cent. germination was obtained after 413 days. Uredospores exposed to summer field conditions at Baton Rouge, Louisiana, failed to germinate after 75 days. Neither self-sown oats nor wild grasses were found in the neighbourhood during the three months from 1st July to 1st October, 1933. Oats were planted locally on 12th October, 1932, and 10th October, 1933, but the first rust found in the 1932–3 season was on 6th February, 1933, the corresponding date for 1933–4 being towards the end of December, 1933. It is inferred from this circumstantial evidence that the inoculum was not present at Baton Rouge during October, November, or early December in either year.

The minimum, optimum, and maximum temperatures for the germination of crown rust uredospores were found to be just above freezing point, 15° to 20°, and slightly below 35°, respectively [*R.A.M.*, xvii, pp. 233, 437; xviii, pp. 306, 389]. The disease developed on plants incubated at 0° to 2° and post-incubated at 20°, but not on those incubated at 10° or 20° and post-incubated at 0° to 2°. The rust presumably gains ingress to the host at very low temperatures, but is prevented from forming uredosori.

Uredospore germ-tubes of *P. coronata*, *P. graminis avenae*, *P. g. tritici*, and *P. triticina* reacted negatively to white, blue, and green light [ibid., xi, p. 563]. In violet light a tendency to negative phototropism was sometimes displayed by all the rusts except *P. g. tritici*, while *P. triticina* behaved similarly under the influence of red light. It is concluded that the blue, and to a lesser extent the violet, rays are responsible for the negatively phototropic reaction of the germ-tubes to white light. The germ-tubes of *P. coronata* appear to enter the host

without difficulty either in light or darkness. Absence of light during the incubation period increased the percentage of severely infected Gopher oats from 57·3 to 62·4 and that of lightly attacked Victory from 12·8 to 33·3.

Fairly abundant uredospore germination of *P. coronata* took place throughout a P_H range of 4·4 (27·6 per cent. germination) to 7·6 (25·7); the minimum, optimum, and maximum hydrogen-ion concentrations for the germination of the rust are about P_H 2·7, 6·7, and 9·2, respectively.

In three years' field trials at St. Paul, Minnesota, and Baton Rouge on some 100 varieties of oats, the most highly resistant was Victoria; Bond was immune in Louisiana in 1933 and 1934, possibly owing to the absence of the physiologic races 33 and 34, to which this variety is susceptible [cf. ibid., ix, p. 771; xiii, p. 156; xv, p. 571; xviii, p. 242]. A 10 per cent. extract of juice from Victoria and Bond reduced the percentage of germ-tube germination after 3½ hours from 48 to 38 and 31·8 per cent., respectively, the corresponding figures for the 28 per cent. concentration being from 46·85 to 8·80 and 12·66, respectively.

MULLER (H. R. A.). **Overzicht van de belangrijkste Citrus-ziekten in Nederlandsch-Indië.** [A survey of the most important Citrus diseases in the Dutch East Indies.]—*Meded. alg. Proefst. Landb., Batavia*, 34, 42 pp., 29 figs., 1939. [English summary.]

This is a comprehensive survey of citrus diseases in the Dutch East Indies, embodying, in addition to information already available, certain new items of interest based on the author's personal observations. The following diseases are enumerated: damping-off of seedlings (*Rhizoctonia* [*Corticium*] *solani*); *Fusarium* root rot of young plants; fungal root rots (*Armillaria* sp., *Rosellinia arcuata*, *R. bunodes*, *Fomes noxius*, and *F. lignosus*); root rot caused by defective soil aeration; wet and dry bark rots due to *Diplodia natalensis*; bark disease (*Dothiorella* [*Botryosphaeria*] *ribis*) [*R.A.M.*, xvii, p. 162]; another form of bark rot produced by *Nectria haematococca* [loc. cit.]; gummosis (*Phytophthora parasitica*) [ibid., xiv, p. 301); 'foam' disease [ibid., x, p. 299]; pink disease (*Corticium salmonicolor*); sun scorch of the bark; *Colletotrichum gloeosporioides* associated with die-back of young trees, withertip, leaf blights (in conjunction with *Gloeosporium limetticolum*), and fruit anthracnose; canker (*Phytomonas* [*Pseudomonas*] *citri*); scab (*Sphaceloma fawcettii* [*Elsinoe fawcetti*]) [ibid., xiv, p. 742]; exanthema; chloroses; mildew (*Oidium tingitaninum*) [ibid., xvii, p. 162]; sooty mould (*Capnodium* sp.); fruit rots (*Phoma citricarpa* [ibid., xviii, p. 671], *Nematospora coryli* [ibid., xvii, p. 162], and *Oospora citri-aurantii* [ibid., xviii, p. 390]); and oleocellosis.

Corticium solani was held in check by weekly applications to the seed-beds of 1·5 per cent. Bordeaux mixture, while soil treatments before sowing with 0·02 per cent. ceresan or 0·05 per cent. terbolan [ibid., xviii, p. 554] were also effective.

The species of *Armillaria* responsible for severe damage in the Malang district of Java from 1934 to 1938 could not be determined with certainty in the absence of fruit bodies. Ten per cent. of the 100,000 affected trees were killed. Good control was effected by excision of

the diseased roots and the application to the remainder of 1·5 to 3 kg. per tree sulphurous volcanic ash containing 60 to 70 per cent. free sulphur, the same quantity being worked into the surrounding soil. The *Rosellinia* root rots were controlled by the same means.

Diplodia natalensis attacks the bark in two ways, one accompanied by profuse gumming, followed by progressive scaling-off of the upper tissue layers until the cambium becomes involved and large patches of the cortex are killed, the fungus ultimately girdling the whole trunk or main branches. Pomelos, oranges, and Ponderosa and Villa Franca lemons are liable to this type of infection. The other form of bark rot, which is dry and relatively inconspicuous, chiefly attacks oranges of the *Citrus nobilis* (mandarin) group and the thicker limbs of pomelo as a sequel to severe scale (*Asterolecanium*) infestation. The spore masses of the fungus protrude through small cortical fissures. Both forms of the disorder may be combated by the excision of the infected tissues and the application to the wounds of a mixture of carbolineum plantarium (92 per cent.) and paraffin (8 per cent.).

Nectria haematococca, one of the principal agents of the death of whole trees or main branches of tangerines in the Batavia district of Java, causes a wet rot of the bark, which becomes covered with the mycelium and spores of the *Fusarium* stage of the fungus; so far control measures have proved ineffectual.

'Foam' disease of mandarin oranges occurs in inadequately irrigated groves in very dry climates. A mixture of the bacteria and yeasts isolated from the malodorous exudate on the bark of affected trees induced the typical symptoms of the disturbance in inoculation experiments, whereas negative results were given by pure cultures of the several organisms. The rot frequently originates at the feeding sites of the beetle *Xylotrupes gideon*, which is probably instrumental in the spread of infection. The application to the invaded areas of lime-sulphur or coal tar gave fairly good control.

Phosphorus deficiency appears to be an important factor in the development of withertip of tangerine twigs and anthracnose of Valencia Late oranges, due in both cases to *Colletotrichum gloeosporioides*.

Oidium tingitaninum may be effectively combated in the plains (below 400 m. above sea-level) by dusting with sulphur, but at higher elevations the use of lime-sulphur (1 in 30) is preferable. Good results have also been obtained with 1 per cent. solbar or mil-du-spra.

P. citricarpa may cause appreciable damage in the pomelo-growing district of Batavia. In fruits still on the trees the necrosis remains confined to the upper layers of the peel, but after picking the peel and pulp are rapidly penetrated, so that an extensive transit rot ensues.

Nematospora coryli was found to be transmitted by the bugs *Rhynchochoris serratus*, *Leptoglossus membranaceus*, and *Cappaea taprobanensis*. Even after only one feeding on diseased fruits immediately following hatching, most of the larvae of *R. serratus* and *C. taprobanensis* retain their infective capacity throughout life, irrespective of successive moultings. It is therefore conjectured, though not definitely known, that the fungus is harboured in the intestines of the insects. *R. serratus*, fed once on diseased fruits and daily thereafter on healthy ones, was still

infective after 65 days. *L. membranaceus* also conveyed *N. coryli* to tomato and *Cyphomandra betacea* fruits both in laboratory and field tests.

Oospora citri-aurantii was experimentally shown to be transmissible by the borer moth *Ophideres fullonica* [*Othreis fullonia*].

[This paper also appears as *Meded. Inst. PlZiekt., Buitenzorg*, 94, 1939, and in *Landbouw*, xv, 5, 1939.]

CROUS (P. A.). **The treatment of sooty blotch on Citrus fruits.**—*Citrus Grower, 1939*, 67, pp. 9, 11–13, 1939. [Abs. in *Chem. Abstr.*, xxxiii, 16, p. 6513, 1939.]

A description is given of the method and apparatus used [in South Africa] for the bleaching of citrus fruits infected with sooty blotch [*Gloeodes pomigena*] in a eusol solution, consisting of $\frac{1}{4}$ lb. each of chloride of lime and boric acid in 1 gal. water [*R.A.M.*, xiv, p. 754].

RAYNER (M. C[HEVELEY]). **The mycorrhizal habit in crop plants, with a reference to Cotton.**—*Emp. Cott. Gr. Rev.*, xvi, 3, pp. 171–179, 1939.

The author records the constant occurrence of the vesicular-arbuscular type of endotrophic mycorrhiza [*Rhizophagus*: *R.A.M.*, xviii, pp. 470, 701] in young plants of Cambodia and Malvi cotton from Indore, India, the infection of the young roots being detected by the increased diameter and greater opacity of the tissues. The incidence and character of infection was observed to vary widely in specimens from the same soil with different manurial treatments. Differential behaviour on the part of the endophyte was particularly well-marked in respect to applications of inorganic as compared with organic manures, and response was also apparent after applications of different kinds of organic manures. Coincidence of vigorous growth of the host with maximum infection may be observed in cotton, and, taken with the histological evidence, this indicates a substantial nutritional balance in favour of the vascular partner.

The author considers that variations in mycorrhizal response can be used as an index of health and growth, but does not suggest that some degree of mycotrophy is necessary for complete nutrition. Her view is rather that for species growing in nature the mycorrhizal condition in a healthy plant expresses a state of physiological equilibrium.

SABET (Y.). **Cotton mycorrhiza.**—*Nature, Lond.*, cxliv, 3635, p. 37, 1939.

The author records the occurrence in Egypt of the typical vesicular-arbuscular endophyte (*Rhizophagus* sp.) within the cortical tissues of cotton [see preceding abstract]. Penetration occurred through the piliferous layer.

KNIGHT (R. L.) & CLOUSTON (T. W.). **The genetics of blackarm resistance. I. Factors B_1 and B_2.**—*J. Genet.*, xxxviii, 1–2, pp. 133–159, 4 pl., 1939.

In a search for varieties of cotton resistant to blackarm (*Bacterium malvacearum*) [*R.A.M.*, xviii, p. 573] large populations of Sakel (a variety of *Gossypium barbadense*) were tested in the Sudan (taking leaf

resistance as a primary basis for selection), but all were found to be equally susceptible. Varying degrees of resistance were present, however, in American Upland strains, and complete immunity in several, though not all, of the Old World types. The genetics of blackarm resistance was studied in crosses between Nye's Uganda B 31, a resistant American Upland strain, and two strains of Sudan-bred Sakel, X 1530 and NT 2, infection being ensured by spraying each plant under test twice daily on three successive days with a suspension of *Bact. malvacearum*. The F_1 generation of B 31 crossed with either of the two Sakel strains was almost as resistant as B 31. The first Sakel back-cross gave a 1:3 ratio of fully susceptible plants to others showing varying degrees of resistance. Plants showing resistance were further back-crossed to Sakel, a 1:3 ratio being obtained in the second and third back-crosses and also a 1:1 in some families of the third. The F_2 of B 31 crossed with either of the two Sakel strains gave a 1:15 ratio of fully susceptible plants to others of varying degrees of resistance, and the first, second, and third back-crosses gave either 1:15 or 1:3 ratios according to the resistance of the parents.

It is concluded from these results that the blackarm resistance of Uganda B 31 is dependent on two major factors, tentatively named B_1 and B_2, which are dominant and cumulative, and each capable of giving a typical form of resistance when added to the Sakel genotype. These factors impart a greater resistance to the Uganda B 31 genotype than to the Sakel, a difference attributed to modifying factors associated with Uganda B 31. Leaf and stem resistance of the hybrids were found to be positively correlated.

Steyaert (R. L.). **La sélection du Cotonnier pour la résistance aux stigmatomycoses.** [Cotton selection for resistance to stigmatomycoses.]—*Publ. Inst. nat. Étud. agron. Congo Belge*, Sér. sci., 16, 29 pp., 3 figs., 7 graphs, 1939.

Detailed results are given of investigations carried out in the Belgian Congo on the selection of cotton strains resistant to stigmatomycosis, caused chiefly by *Nematospora coryli* and *Ashbya* [*N.*] *gossypii* [*R.A.M.*, xviii, p. 308], resistance being tested by means of artificial infections of the bolls. It was found that family 145 of Triumph Big Boll is resistant to both fungi and, in addition, has remarkable commercial qualities. Subfamily 145–C–55–214 (referred to as 145–214) is resistant to *N. coryli*, and two subfamilies of 145 proved equally resistant to *N. gossypii*. Line 10–F–122 appears to show resistance to *N. gossypii* and deserves further study.

Brixhe (A.). **La fusariose ou 'wilt' du Cotonnier.** [Fusariosis or 'wilt' of the Cotton plant.]—*Bull. Com. coton. congol.*, iv, 14, pp. 49–54, 4 figs., 1939.

The appearance of cotton wilt (*Fusarium vasinfectum*) in the northern districts of the Belgian Congo during the last growing season [*R.A.M.*, xviii, p. 248] having been authoritatively announced by the Inéac Phytopathological Service, the writer gives a semi-popular account of the causal organism, and its control by stringent sanitary precautions in the field and the development of resistant varieties.

COSTA (A. S.) & FRAGA (C. G.). **Sôbre a natureza da ramulóse ou superbrotamento do Algodoeiro.** [On the nature of ramulosis or excess budding of Cotton.]—*J. Agron., S. Paulo*, ii, 3, pp. 151–160, 2 figs., 1939. [English summary.]

A cotton disease in São Paulo, previously described by the authors in *Bol. téc. Inst. agron., Campinas*, 29, 1937, as 'excess budding' or 'ramulosis', the cause of which was obscure, is now tentatively attributed to a new variety of *Colletotrichum gossypii*, referred to as var. *cephalosporioides* [without a diagnosis]. This variety closely resembles *C.* [*Glomerella*] *gossypii* in its morphological characters, and may, in fact, be merely an exceptionally aggressive form of the anthracnose fungus [*R.A.M.*, xvi, p. 606]. The two organisms, however, besides differing culturally, show marked divergences in pathogenicity towards the Barberton C. 96 and Gatooma varieties of *Gossypium hirsutum*. Thus, in an inoculation test on 40 Barberton plants with spore suspensions of both fungi, *C. gossypii* var. *cephalosporioides* infected 16 and *G. gossypii* none, while in four trials on Gatooma the former gave positive results in 34 out of 36, 13 out of 14, 7 out of 15, and 15 out of 15 cases, while the latter was uniformly unsuccessful in inducing the typical symptoms of the disease.

DRECHSLER (C.). **Five new Zoopogaceae destructive to Rhizopods and Nematodes.**—*Mycologia*, xxxi, 4, pp. 338–415, 5 figs., 1939.

Latin and English diagnoses and full descriptions are given of one new genus and five new species of Zoopagaceae [*R.A.M.*, xviii, p. 454] destructive to soil rhizopods and nematodes and occurring in decayed plant remains and leaf moulds in the United States, namely: *Stylopage scoliospora*, *S. rhynchospora*, *Cochlonema pumilum*, *C. fusisporum*, and finally *Euryancale sacciospora* n.g., n.sp. The last-named, which is destructive to nematodes belonging to a species of *Bunonema*, gives rise to a conidial apparatus differing from any hitherto represented in this group and thus makes necessary the erection of a new genus. A sexual stage has been observed only in *S. rhynchospora*, and an expanded account is also given of the sexual stage of *S. araea*, a species described in a previous paper [ibid., xiv, p. 508].

MAINS (E. B.). **Cordyceps from the mountains of North Carolina and Tennessee.**—*J. Elisha Mitchell sci. Soc.*, lv, 1, pp. 117–129, 4 pl., 1939.

This is a list of 20 species of *Cordyceps* occurring in the mountainous area of western North Carolina and eastern Tennessee, with a key to the species and a host index. Three new species are described, namely: *C. thaxteri*, the conidial stage of which is apparently *Isaria arachnophila*, later renamed by Petch *Hymenostilbe arachnophila* [*R.A.M.*, xi, p. 299], *C. hesleri*, and *C. smithii*.

TIFFNEY (W. N.). **The identity of certain species of the Saprolegniaceae parasitic to fish.**—*J. Elisha Mitchell sci. Soc.*, lv, 1, pp. 134–151, 1939.

In this study 128 strains of Saprolegniaceae were isolated in southern

New England from living diseased fish, newts, frogs, and turtles; representative strains were then reisolated from single spores and their pathogenicity proved in inoculation experiments. Of the strains isolated, two formed sexual organs and were identified as *Saprolegnia ferax* [*R.A.M.*, xvi, p. 745], 122 strains lacked the sexual stage and are referred to *S. parasitica* [ibid., xviii, p. 591], three belonged to *Achlya* (two of these to *A. flagellata* [ibid., xviii, p. 454]), and one to *Dictyuchus* (probably *D. monosporus*). One of the two strains of *S. ferax* obtained resembled in its asexual stage *S. parasitica* and was induced to fruit by growing it on a whole hemp seed with the seed coat punctured by one small prick. Of the strains of *S. parasitica* present some agreed closely with Coker's type species while others differed in various respects, but these more or less marked variations in vegetative and asexual reproductive structures are not considered to be of diagnostic value and merely extend the present range of variation within the species. In the author's view *S. parasitica* should be considered a species of convenience until further studies have demonstrated its exact nature. He does not accept the establishment of the variety *kochhari* by Chaudhuri and Kochhar [*Proc. Indian Acad. Sci.*, ii, pp. 137–154, 1935] on the basis of zoosporangial length, since the range of this length should be extended to include forms measuring from 70 to 893 μ. The method of zoosporangial renewal by cymose branching was found to be more variable and therefore of less diagnostic value than might be expected, and in view of these findings the author sees no necessity for transferring *S. parasitica* to the genus *Isoachlya*.

The strains of *Achlya* and that of *Dictyuchus* were shown to be wound parasites; so far as the author is aware this is the first record of a species of *Dictyuchus* parasitic on animals.

Pratt (H. N.). **Mold spore content of the air in Boston with reference to atopic sensitivity.**—*J. Pediat.*, xiv, 2, pp. 234–241, 1 diag., 2 graphs, 1939.

The writer exposed Petri dishes containing Sabouraud's agar to the outside air of Boston, Massachusetts, for half-an-hour daily for 14 months (February, 1937 to April, 1938). *Alternaria*, *Hormodendrum*, and unidentified non-spore-bearing moulds increased gradually in numbers during the spring, reached a climax from July to September, and declined in October and November, whereas no seasonal fluctuations were shown by *Aspergillus* and *Penicillium*, and the slight multiplication of *Chaetomium* in August and September is regarded as insignificant. Of 177 children suffering from asthma and hay-fever, 25 per cent. reacted strongly to the intracutaneous injection of *Alternaria* [*R.A.M.*, xviii, p. 737] extracts, the numbers responding similarly to *Aspergillus*, *Hormodendrum*, and *Penicillium* being only 4, 6, and 2·5 per cent., respectively. The seasonal incidence of symptoms among the patients reacting positively to mould extracts closely corresponded to the variations in the spore content of the atmosphere, taking into account the effect of coexisting pollen sensitivity. Nine out of eleven children given specific mould therapy in 1937 obtained marked relief.

NIÑO (F. L.). **Aspectos microscópicos de los granulomas llamados blastomicósicos.** [Microscopic aspects of the so-called blastomycotic granulomata.]—*Prensa méd. argent.*, xxv (ii), 47, pp. 2203–2214, 16 figs., 1938.

This is a detailed account of the histological reactions of various organs of the human body to invasion by certain fungi causing the development in the Argentine of the so-called 'blastomycotic' granulomata, viz., *Cryptococcus* [*Debaryomyces*] *neoformans* [*R.A.M.*, xviii, p. 676], *Paracoccidioides brasiliensis* [ibid., xviii, p. 252] and *P. cerebriformis* [ibid., xvi, p. 318], *Coccidioides immitis* [ibid., xviii, p. 594 and next abstracts], *Zymonema* [*Endomyces*] *dermatitidis* [ibid., xviii, p. 677], various agents of chromoblastomycosis, e.g., *Phialophora*, *Acrotheca*, and *Hormodendrum* spp. [ibid., xviii, p. 28], and *Rhinosporidium seeberi* [ibid., xviii, p. 593].

HYNES (K. E.). **Coccidioidal granuloma.**—*Northwest Med., Seattle*, xxxviii, 1, pp. 19–21, 4 figs., 1939.

Full clinical details are given of two cases of systemic coccidioidal granuloma (*Coccidioides*) [*immitis*: see preceding and next abstracts], both contracted in California, in young male Filipinos, one of whom succumbed to the disease while the other made an apparently complete recovery following the administration of sulphanilamide over a period of six weeks.

FARNESS (O. J.) & MILLS (C. W.). **Coccidioides infection: a case of primary infection in the lung with cavity formation and healing.**—*Amer. Rev. Tuberc.*, xxxix, 2, pp. 266–273, 6 figs., 1939.

The authors describe a case of pulmonary infection by *Coccidioides immitis* [see preceding abstracts], probably primary in the lung, following an insect sting in a 15-year-old Michigan boy at the Desert Sanatorium, Arizona. Unusual features of the disease include its development outside California, the absence of constitutional symptoms, and early cavity formation. A cure was effected by rest, artificial pneumothorax, and specific vaccine therapy.

DANG-VAN-NGU. **La piedra noire au Tonkin et en Annam.** [Black 'piedra' in Tonkin and Annam.]—*Ann. Parasit. hum. comp.*, xvii, 4, pp. 359–363, 1 pl., 1939.

In March and April, 1939, the author observed several cases of the hair affection, black 'piedra', on male students in Annam and Tonkin. The nodules were hard, adherent, opaque, truncated, irregularly cylindrical or fusiform, not over 1·5 mm. long by 0·5 mm. wide. The fungus of which they consisted agreed with the descriptions of *Piedraia hortai* [*R.A.M.*, xviii, p. 526], showing asci, arranged perpendicularly to the axis of the hair, 30 to 50 (average 44·8) by 25 to 30 (average 31·6) μ, each with 8 S-shaped ascospores, 38 by 6 μ, bearing polar filaments 8 to 10 μ long. Cultures from this material gave characteristic black colonies in five days. Transverse sections of affected hairs showed the raising of the epidermal cuticle described by Brumpt and Langeron [ibid., xiii, p. 512], which could be folded over upon itself and sometimes contained asci in the concave part, simulating true perithecia.

It was found that in many cases the hyphae passed into the hair fibrils, concentric lamellae forming on the surface. Sometimes the hyphae reached the medulla of the hair directly, by passing along a radial fissure. The lesions did not render the hair brittle. The known geographical distribution of the disease shows that black 'piedra' has a strong affinity for very wet climates.

Calinisan (M. R.). **A comprehensive study on symptoms of Abacá mosaic.**—*Philipp. J. Agric.*, x, 2, pp. 121–130, 9 pl., 1939.

The first symptom of abacá [*Musa textilis*] mosaic [*R.A.M.*, xiv, p. 311; xviii, p. 397] in the Philippine Islands is the appearance of spindle-shaped chlorotic areas, measuring 20 to 30 by 2 to 3 mm., on the under side of the leaf parallel to the veins. The chlorotic areas are at first localized, but later they may coalesce and vary in colour from pale yellowish green to a rusty brown. There is often a green dot in the centre of each area. On the unfurled leaves the patterns may be sharply delineated. On the youngest folded leaf the characteristic symptom consists of bands of yellowish streaks alternating with wider stripes of normal green. Infected leaves are sometimes irregularly corrugated. Occasionally a mosaic-infected leaf is followed by an apparently healthy one, but the symptoms reappear on succeeding leaves. Leaves produced prior to infection do not develop symptoms.

Occasionally the first symptom appears as light yellow or orange streaks on the midrib. The subsequent leaf may show more distinct, elongated, yellowish streaks on the petiole or midrib, with no mottle on the leaf. The next ensuing leaf may show characteristic mottling of the petiole, midrib, and leaf blade. As a rule, when the petioles of an infected leaf is salmon or rusty, the inner tissues are discoloured or necrotic. In more advanced stages the tissues turn black and die. The streaks on the midrib, and petioles vary in size and shape, appearing dark green with a yellowish background.

Similar symptoms may appear on the pseudostem and, when present, are clearly visible if the outermost leaf sheath is removed. Newly emerged inflorescences may show distinct spindle-shaped streaks on the outer surface of the bract. When the infected bracts are removed they leave discoloured scars on the rachis. Diseased fruits show violet, wedge-shaped streaks on all four sides, and when cut open reveal a brown discoloration of the inner tissues. Occasionally such fruits are sterile and decay.

Curtis (J. T.). **The relation of specificity of Orchid mycorrhizal fungi to the problem of symbiosis.**—*Amer. J. Bot.*, xxvi, 6, pp. 390–398, 9 figs., 1939.

In continuation of his studies on orchid mycorrhiza [*R.A.M.*, xvi, p. 466] the author reports that isolations of mycorrhizal fungi from 23 species of orchids from the United States and Mexico yielded ten species of *Rhizoctonia*, including two new ones and one new variety [with diagnoses in English only]. Of these, *R. borealis* n.sp. (isolated from *Goodyera repens* var. *ophioides* and *Spiranthes gracilis*, both in Wisconsin) is described as showing tan, later dark-brown, mycelium, numerous sporodochia up to 3 mm. in diameter, distinct from the rapidly growing

mycelium, and *Clostridium*-like 'spores' measuring 37 to 42 by 24 to 28 μ. In liquid cultures the fungus formed a mat of aerial hyphae. The hyphal tips are characterized by an unusual regularity of dichotomous branching before spore formation. It is very similar to *R. mucoroides* except for its much larger size. *R. monilioides* n.sp. shows cottony aerial hyphae on agar cultures. No sporodochia are formed. The spores, measuring 10 to 14 by 7 to 10 μ, are arranged in branched, monilioid chains comprising from 10 to 18 spores. It differs from *R. repens* in the very long spore chains, slightly smaller spores, and absence of sporodochia. *R. subtilis* var. *nigra* n. var. differs from the typical species by its black mycelium and larger size (10 to 13 by 7 to 9 μ) of its spores.

No evidence of specificity was found in the orchid-fungus relationship, as one species of orchid could harbour as many as four species of *Rhizoctonia* and one species of *Rhizoctonia* could infect seven different orchids. Additional proof was obtained of a correlation between the fungus species and ecological habitat, though a few species occurred in a variety of habitats. Further evidence of non-specificity was afforded by the fact that the fungi isolated from an orchid were mostly unable to induce germination of its seed. It is concluded that the symbiotic relationship is one of parasite and host, the orchid deriving no benefit from the presence of the fungus in its roots.

CHESTERS (C. G. C.) & HICKMAN (C. J.). **Preliminary report on stem and root rot of Viola and Pansy.**—Reprinted from *Nat. Viola & Pansy Soc. Yearb., 1938*, 8 pp., 7 figs., [1939].

The most serious disease affecting violas and pansies in England is probably the complex known as root and stem rot. The first sign of attack is yellowing of the leaf margins, the discoloration spreading over the surface and being followed by the appearance of purple or purple-brown tints. Finally, the leaves wilt and shrivel, and the entire plant collapses. The diseased plants fall into two classes, viz., those infected by *Myrothecium roridum* [*R.A.M.*, xvi, p. 319], which is normally confined to the stem near soil-level, and those attacked by *Corticium solani* or species of *Pythium* [ibid., xvi, p. 813], both of which affect the root system and stem. In this second form of the disease (the subject of the present study), the mycelium of *C. solani* only is usually found when the diseased tissue is dry, but if it is soft and moist, species of *Pythium* are almost always present, though sometimes accompanied by *C. solani*. Infection reaches epidemic proportions after the setting of the first blooms, while a slow form also occurs on cuttings or second year plants in winter. As a rule, one fungus is responsible for epidemic outbreaks, while two or more organisms may be present in the slow form.

Three species of *Pythium* (referred to as types D, E, and H) were isolated from diseased material. Placed in soil under the roots or round the collar of established plants all three types produced typical root and stem rot, as they did when clean viola seedlings were planted in inoculated garden soil.

The disease was observed to be most prevalent on heavy clay soils and those made heavy by the addition of heavy dressings of organic matter, the soils in question being almost invariably extremely moist. It is believed that the disease will cease to cause trouble if violas are

grown in fertile, open soil, the surface of which is protected from excessive heating. Spread was arrested by the prompt removal and destruction of diseased plants, and applications between the plants of Cheshunt compound. The disease is only carried by cuttings containing infected tissue and taken from plants with soft, discoloured stems, but clean, poor-quality cuttings may produce weak roots which easily become infected.

YARWOOD (C. E.). **An overwintering pycnidial stage of Cicinnobolus.**—*Mycologia*, xxxi, 4, pp. 420–422, 1 fig., 1939.

In experiments carried out during the years 1931 to 1936 in Indiana, Wisconsin, and California, the author found a pycnidial stage of *Cicinnobolus cesatii* [*R.A.M.*, xvii, p. 843], a parasite of *Erysiphe* spp., developing saprophytically in the tissues of dead overwintered leaves of clover and cucumber, which had been inoculated while living in the previous autumn with *Erysiphe polygoni* and *E. cichoracearum*, respectively, and then with *C. cesatii*. Pycnidia formed parasitically are light brown, thin-walled, 39 to 54 by 18 to 29 μ, discharging spores, 3·5 to 8·4 by 1·9 to 4·1 μ, through an irregular opening at the apex; those formed saprophytically are dark brown, thick-walled, spherical, 79 to 140 μ in diameter, with a well-formed ostiole, and spores 6·0 to 11·1 by 1·8 to 3·2 μ. Cultures from the overwintered leaves were parasitic on living clover mildew and the fungus is believed to overwinter in the saprophytic form.

RICHTER (H.). **Die Viruskrankheiten der Lupine. Mit Anhang: Übertragung und Überwinterung des Lupinenbräune-Virus von K. Heinze.** [The virus diseases of the Lupin. With addendum: the transmission and overwintering of the Lupin browning virus by K. Heinze.]—*Mitt. biol. Anst.* (*Reichsanst.*), *Berl.*, 59, pp. 75–86, 12 figs., 1939.

Descriptions are given of lupin mosaic [*R.A.M.*, xvi, p. 518] and browning in Germany [ibid., xvi, p. 680], the former affecting *Lupinus mutabilis*, *L. luteus*, and *L. angustifolius*, the last-named in an atypical manner, involving chlorosis, suppression of flowering, and the development of a witches' broom habit.

All the commercial varieties are susceptible to browning, *L. angustifolius* being the most and *L. mutabilis* the least so. Positive results in the transmission of browning (cucumber virus 1) from diseased to healthy plants were obtained with *Myzus persicae*, *Aphis rumicis*, *Doralis* [*A.*] *rhamni*, and *M. pseudosolani*, among which *A. rhamni* has not hitherto been recorded as a vector. The following plants were found to act as alternate hosts of the virus in the Berlin district: cucumber, spinach, tomato, tobacco, *Galinsoga parviflora*, *Capsella bursa-pastoris*, *Viola tricolor*, *Stellaria media*, *Chelidonium majus*, *Datura stramonium*, *Aquilegia vulgaris*, *Senecio elegans*, *Zinnia elegans*, China aster, wallflower, *Eryngium planum*, and *Scabiosa maritima* var. *atropurpurea*. Since the virus does not overwinter in its insect carriers and is not seed-borne, it is apparent that hardy garden annuals and perennial or annual weeds provide the sole means of perpetuation. Lupin crops should therefore not be cultivated in proximity to gardens or

horticultural establishments. The thorough eradication of weeds is an indispensable precaution, and early sowing is advisable in areas where there is a risk of virus infection.

Report of the Low Temperature Research Laboratory, Capetown, 1936-1937.—184 pp., 28 figs., 4 diags., 22 graphs, 1938. [Received August, 1939.]

On pp. 38–53 of this report [cf. *R.A.M.*, xvii, p. 469] R. Davies, W. W. Boyes, and D. J. R. de Villiers give further results of their investigations into the internal breakdown of Japanese plum varieties. A storage temperature of 34° F. for 24 days and subsequent ripening at 65° proved unsuitable, as far as breakdown is concerned, for the varieties Santa Rosa (ripest fruits), Wickson, Gaviota (some consignments), Methley, Apple, Satsuma, and Chalcot, and suitable for Santa Rosa (greenest fruits), Gaviota (some consignments), Beauty, and Formosa; a storage temperature of 45° proved unsuitable for Wickson (ripest fruits), Methley, Beauty, and Chalcot (ripest fruits), and suitable for Santa Rosa, Wickson (greenest fruits), Gaviota, Apple, Satsuma, Chalcot (greenish fruits), and Formosa. For the Methley variety storage at 31° is indicated, and it is probable that temperatures above 45° may be best for Wickson. The ripest stage, as measured by the pressure test, that will yield fruit free from breakdown and allow at least five days for ripening at 65° after storage at 45°, is given as 12, 13 to 15, 10 to 12, 15, 12 to 14, and 7 to 8 for the varieties Santa Rosa, Wickson, Gaviota, Apple, Satsuma, and Formosa, respectively. Delayed storage of Santa Rosa plums at 31° resulted at first in an increase in the amount of breakdown and then a decrease after 7 to 10 days; delayed storage at 37° resulted in a decrease up to 7 days, then an increase up to 13 days, and a second fall at still further delay.

From further experiments on woolliness of Peregrine peaches [loc. cit.], R. Davies, W. W. Boyes, and D. J. R. de Villiers (pp. 53–67) draw the following conclusions: no woolliness is produced during storage for 24 days at 31° irrespective of the period of delay; the condition increases with an increase of storage temperatures; when temperatures higher than 31° are used woolliness can be reduced to reasonable proportions by pre-storing for two to three days at 75°, four or more days at 65°, and eight or more days at 50°, although it is noted that delayed storage at 50° produces abnormalities in ripening other than those of woolliness. The lower the temperature of storage the better the quality of the fruit, and the higher the storage temperature the greater the intensity and incidence of 'pink flesh'; ripening the fruit at 65° following storage at 34° and 37° (but not 31°) encourages the development of 'pink flesh', while ripening the fruit at 45° reduces it to negligible proportions except in fruit stored at 37°.

In experiments on grape wastage, due to *Botrytis* [*cinerea*: ibid., xvii, p. 499] and *Penicillium* [ibid., xvi, p. 437], conducted during 1937 by J. M. Rattray (pp. 75–91), the wastage of Gros Colman grapes showed a general tendency to increase with maturity. Wilting over night before packing did not significantly increase the *Botrytis* wastage in Raisin Blanc grapes, but it increased the percentage of 'loose neck' from 3·4 in grapes packed immediately after picking to 8·5. Treating

sulphite wrappers with orthophenylphenol [ibid., xviii, p. 589] reduced the *Penicillium* wastage in Gros Colman grapes from 8·5 to 1·1 per cent., but the percentage of *Botrytis* wastage was even higher than in the control; the same substance used in wax (10 gm. in 100), however, reduced *Botrytis* wastage in Henab Turki grapes from 69 to 21·7 per cent., but several bunches developed an off-flavour. Dipping Gros Colman grapes in a solution of 95 per cent. alcohol and 4 per cent. acetic acid for a few seconds reduced the percentage of *Botrytis* wastage in the trimmed bunches from 100 to 28, but had no effect on untrimmed ones. Fumigation on a commercial scale with 3 or 5 per cent. formaldehyde reduced *Botrytis* wastage in White Hanepoot and Henab Turki grapes but the amount of drop was increased in every case. The stronger concentration of formaldehyde had an adverse effect on the condition of stems.

Data obtained by E. Beyers (pp. 91–101) during 1937 again confirmed the detrimental effect of delayed and long storage on the incidence of drop in Waltham Cross grapes [loc. cit.]. The results of 1937 again showed that grapes picked at a riper stage were slightly less susceptible to drop than green grapes. So far the only available means of checking drop lies in the prompt cooling of the grapes after picking and the provision of ample soil moisture.

J. M. Rattray and E. Beyers (pp. 102–112) conclude from the results of their experiments that although the use of waxed crystalline paper wrappers for grapes has a beneficial effect on the general appearance of the bunches and the freshness of the stalks, yet the susceptibility to mould wastage [*B. cinerea* and *Penicillium*] is correspondingly increased and may assume far more serious proportions than with the sulphite wrappers.

J. E. van der Plank (pp. 159–172), describing the different forms of cold injury on Marsh grapefruit, states that at a storage temperature of 31·5° the injury usually appears in the form of numerous pin-head pits, either scattered over the whole surface of the fruit, or clustered together over a small portion of it, the symptoms being similar to the 'mild' pitting, described by Brooks and McColloch [ibid., xv, p. 498]; at 35° the pits are usually larger and more distinct and are surrounded by a halo, resulting from the browning of the tissue between the oil cells; at 39° the pits are well defined, up to $\frac{1}{4}$ in. or more in diameter, and show concentric halos; and at 45° large and diffuse brown blotches tend to develop instead of pits. Navel oranges stored at 30° to 32° are stated to show 'gooseflesh' [ibid., xvii, p. 444]; at 35° a browning of the tissue round the oil vesicles and a number of irregular small pits may occur; and at 39° to 45° well-defined pits develop, usually surrounded by a halo, while browning is relatively rare. No confirmation was found for the alleged fungal origin of button-browning [ibid., xiv, p. 755] and the trouble is attributed to cold injury. Stylar end blotching of grapefruit, characterized by small irregular blotches, often associated with a halo, was observed to occur frequently, particularly at the end of the season, but is thought to be of little importance. Three types of lesions were found on Navel oranges stored at 55° and to a lesser extent at 50°, but not at lower temperatures, characterized by (*a*) brown to almost black, circular, occasionally irregular spots, slightly sunken, but not penetrating deeply into the

rind, closely resembling 'brown spot' described by Fawcett [ibid., xv, p. 574]; (*b*) irregular and more sunken spots found in coarser-skinned fruits; and (*c*) irregular, shallow, brown to black spots appearing within a month and greatly increasing with prolonged storage. Types (*a*) and (*b*) are due to physiological breakdown and (*c*) to an unidentified fungus.

In cold storage tests with Rome Beauty apples, described by W. E. Isaac and W. W. Boyes (pp. 180–184), the higher the storage temperature the sooner did superficial scald develop, but temperature had little effect on its incidence.

Gaudineau [Mlle (M.)], Raucourt, & Morel (G.). **Observations sur la forme parfaite de Venturia inaequalis et de Venturia pirina.** [Observations on the perfect form of *Venturia inaequalis* and *V. pirina*.]—*Rev. Path. vég.*, xxvi, 2, pp. 148–154, 2 pl., 1939.

In this paper the authors give details of the occurrence of *Venturia inaequalis* on apple and *V. pirina* on pear in the perfect stage in France, the record of which has already been noted from another source [*R.A.M.*, xviii, p. 688: but note, p. 689, l. 4, for 'perithecia' read 'conidia'].

Schad (C.) & Soulié (H.). **Note sur la recherche des périthèces des tavelures du Pommier et du Poirier dans la région du Centre en 1938.** [A note on the search for the perithecia of Apple and Pear scab in Central France in 1938.]—*Rev. Path. vég.*, xxvi, 2, pp. 160–162, 1939.

In this note the authors discuss the occurrence of perithecia of *Venturia inaequalis* on apple and *V. pirina* on pear in central France, the record of which has already been noted from another source [see preceding abstract].

Goldsworthy (M. C.) & Green (E. L.). **The fungicidal activity of phenothiazine and some of its oxidation derivatives.**—*Phytopathology*, xxix, 8, pp. 700–716, 1939.

A fully tabulated account is given of the writers' laboratory experiments on the toxicity of saturated solutions of phenothiazine and its derivatives, phenothiazine sulphoxide, phenothiazone, and thionol, and of weathered and non-weathered phenothiazine-lime-bentonite residues to the conidia of *Sclerotinia fructicola* and *Glomerella cingulata*, supplemented in the case of phenothiazine only by field tests in the control of apple scab (*Venturia inaequalis*).

Phenothiazone proved to be the most effective fungicide of the group, destroying the conidia of *S. fructicola* and *G. cingulata* at a concentration of several parts per million. It was shown, by chloroform solubility, sublimation, and spectrum absorption and transmission tests, to be the toxic product resulting from the oxidation of phenothiazine and phenothiazine sulphoxide in the presence of air, light, and water. Phenothiazine residues and saturated aqueous solutions, unaltered by oxidation, were non-toxic to the conidia of both organisms. Good control of apple scab was obtained in an Indiana orchard by the application of phenothiazine sprays, wetted by soluble fish-oil soap, at the rate of 2 lb. per 50 gals. water.

The conidia of *S. fructicola*, but not those of *G. cingulata*, succumbed to phenothiazine sulphoxide oxidized in alkaline residues. Saturated aqueous solutions of the same compound, following oxidation by strong light in the presence of air, were toxic to the conidia of both fungi.

Oxidized thionol residues destroyed the conidia of *S. fructicola* but not those of *G. cingulata*, while saturated solutions of thionol were non-toxic to both.

BAINES (R. C.). **Phytophthora trunk canker or collar rot of Apple trees.**—*J. agric. Res.*, lix, 3, pp. 159–184, 1 pl., 4 figs., 1939.

This is a full account of the author's investigations into the canker or collar rot disease of apple trees (*Phytophthora cactorum*), most of which has been reported from other sources [*R.A.M.*, xiv, p. 371; xvii, p. 399; xviii, p. 320]. From a review of the relevant literature the author concludes that the disease occurred in Indiana as early as 1900. In six orchards the percentage of infection of Grimes Golden trees (14 to 18 years old) ranged from 21 to 85 during 1933–4 and in two of these orchards from 0 to 6 per annum from 1935 to 1937. Partial control of the disease on Grimes Golden was obtained in one orchard by spraying with Bordeaux mixture 16–16–100 and 30–30–100 after the dormant period, the percentage of trees showing canker development during 1935, 1936, and 1937 being thereby reduced from 9, 4, and 0·8 on the unsprayed controls to 3, 1, and 0·6, respectively. Treatment of trunk cankers with a 10 per cent. solution of sodium arsenite in 50 per cent. alcohol seemed to check their further development.

WILLISON (R. S.). **Fall spray injury to Peach trees.**—*Sci. Agric.*, xix, 11, pp. 670–672, 2 pl., 1939.

In March, 1938, peach trees near Lake Ontario sprayed in November, 1937, with a 1:7 lime-sulphur mixture showed injury, mainly confined to weak, slender twigs, formed late in the growing season. Many of these had been killed, while in others injury was confined to small, necrotic areas round the leaf scars. Sections of leaf bases showed no periderm formation, the only barrier to penetration through the scar being a protective layer of dead tissue. In the injured leaf bases the spray had penetrated and bleached this layer, while in mounted sections crystals (apparently of elemental sulphur) had formed over the surface of the bleached areas, probably precipitated by the lactophenol mounting solution. Trees in another orchard sprayed with lime-sulphur in November, 1937, showed no injury in the following March, but under leaf scars covered with spray residue bleaching, with a crystal deposit as in injured twigs, was noted in the outer part of the protective layer. In no instance, however, had penetration reached the living cells. The evidence indicates that in cases of injury from autumn spraying with lime-sulphur the leaf scar with its leaf traces is a main avenue of penetration.

WARDLAW (C. W.). **Cercospora leaf spot disease of Bananas.**—*Nature, Lond.*, cxliv, 3635, pp. 11–14, 2 figs., 1939.

The author gives a concise account of banana leaf spot (*Cercospora musae*) [*R.A.M.*, xviii, p. 748] as it occurs in Trinidad.

Baker (R. E. D.). **Papaw mosaic disease.**—*Trop. Agriculture, Trin.*, xvi, 7, pp. 159–163, 13 figs., 1 graph, 1939.

Papaw mosaic [*R.A.M.*, xvi, p. 729] is stated to be very common in Trinidad, where it appears to be still gaining ground. The symptoms are very variable. Typically water-soaked areas, known as 'oil spots', on the petioles and a marked mosaic on the laminae of newly formed leaves appear almost simultaneously, while older leaves remain unaffected. In some cases no marked mosaic but only a general chlorosis develops. The growing point usually becomes involved after three to four weeks and the crown of the tree dies after eight to nine, a secondary rotting setting in rapidly followed by a profuse development of the lower axillary branches. There is evidence that vigorous trees are more readily attacked than weaker ones. Trees have been observed to recover naturally and sometimes are attacked more than once.

The disease, as it occurs in Trinidad, is believed to be identical with mosaic described from Jamaica [ibid., xi, pp. 26, 625], and one type of 'curly leaf' from San Domingo [ibid., ix, p. 512] where two diseases appear to have been described as one. The Trinidad disease is considered to be distinct from the bunchy top of Puerto Rico [ibid., xviii, p. 375], although it might be caused by another strain of the same virus, and from the second type of 'curly leaf' from San Domingo which is believed to be identical with bunchy top. A disease similar to that in Puerto Rico is reported from Queensland under the name of 'yellow crinkle' [ibid., xviii, p. 657]. Discussing the possible cause of the disease, the author expresses the opinion that it is probably caused by an insect-borne virus and belongs to the group of virus diseases transmissible by insects only and not by sap inoculations. By far the commonest insect in the plantations was an Aleyrodid white fly which is considered to be a possible vector, though transmission experiments with it, and by sap inoculation or grafting, have so far given negative results. For control the trees should be cut back at least 3 or 4 ft. behind the growing point, and as the stem is hollow, the cut surface should be covered with an inverted jam tin or filled in with concrete as a protection against the breeding of mosquitoes and the eventual rotting of the tree. This method has proved successful on a small scale in Trinidad, but it has yet to be tested on a large one.

Robertson (W. C.). **Fungicides Act 1935. Registrations for the year 1939.**—*J. Dep. Agric. Vict.*, xxxvii, 6, pp. 281–283, 301, 2 figs., 1939.

This is a general critical survey of over 400 brands of fungicides and insecticides (a list of which is issued as a supplement to the *Journal*) registered under the Fungicides Act for the year 1939 in Victoria.

Garrett (S. D.), Glynne (Mary D.), Hickman (C. J.), Williams (P. H.), & Ogilvie (L.). **Symposium and discussion on root rots.**—*Trans. Brit. mycol. Soc.*, xxiii, 2, pp. 209–213, 1939.

In a symposium held at the meeting of the British Mycological Society on 28th January, 1939, in London, S. D. Garrett discussed the ecology and world distribution of cereal root rot fungi [*R.A.M.*, xvii, p. 625],

classifying *Ophiobolus graminis* on wheat as a semi-obligate parasite and *Fusarium culmorum* as a typical facultative parasite.

In a field study on the gradual invasion of the roots of healthy wheat plants by fungi carried out at Rothamsted by Mary D. Glynne during 1936–7, the number of isolations made at four- or six-weekly intervals throughout the growing season is stated to have steadily increased as the season advanced, being very high by June. About 50 per cent. of the fungi isolated were sterile forms, some of them occurring very frequently; of the remainder *Periconia circinata* and an apparently new species of *Pullularia* are worthy of mention.

From the results obtained in a six months' field study at Westerham, Kent, on the 'red core' disease of strawberries [ibid., xviii, p. 123] C. J. Hickman tentatively concludes that a species of *Phytophthora* is the primary cause of this disease, the parasitic activity of the fungus being largely governed by soil wetness. The fungal flora isolated from roots of cultivated and wild strawberry plants suffering from black root rot [ibid., xvi, p. 760] is stated to include species of *Fusarium*, *Rhizoctonia*, *Pythium*, *Cylindrocarpon*, *Coniothyrium*, *Hainesia*, *Alternaria*, *Verticillium*, and *Pachybasidium*, but their relative importance in the etiology of the disease has not yet been determined.

Further contributions to the symposium were made by P. H. Williams, who read a paper on the root rots of glasshouse plants, and L. Ogilvie, who discussed the influence of certain environmental factors on the incidence of five diseases of vegetables prevalent in Worcestershire.

Couch (J. N.). **Technic for collection, isolation and culture of Chytrids.**—*J. Elisha Mitchell sci. Soc.*, lv, 1, pp. 208–214, 1939.

The following methods are described for the isolation of 15 representative species of Chytridiales [which are listed] in pure fungal culture: (1) isolation in water of a single sporangium, (2) on agar of a single sporangium, (3) of zoospores from a single sporangium on a slide, (4) of a single zoospore in a capillary tube, (5) of a single zoospore on agar, and (6) of a single thread or several threads of mycelium on agar. Some of the isolations have been maintained in culture for as long as seven years. Boiled leaves and pollen were the usual substrata but four species have been grown on boiled filter paper, bacteria being present in such cultures and being apparently necessary for growth. Usually zoospore germination was best on agars with small amounts of nutrient or even on plain agar.

Jørgensen (A.), Hansen (A.), & Lund (A.). **Micro-organisms and fermentation.**—xii+416 pp., 40 pl., 21 figs., London, Charles Griffin & Co., Ltd., 1939. 30*s*.

This volume, prepared with the assistance of C. Ainsworth Mitchell, is the sixth edition of Jørgensen's well-known book, the text of which has been so extensively revised as to constitute an entirely new work. The original plan remains essentially unaltered, but the manner of presentation has been brought up to date throughout. The parts describing several important biochemical processes have been expanded, and those relating to certain rare micro-organisms omitted. The form

is that of a text-book in which the authors discuss the principal organisms involved in brewing, distilling, yeast manufacture, wine-making, and dairying. Nearly all the original illustrations have been replaced by photomicrographs.

DAMERON (W. H.) & SMITH (H. P.). **Prickly Pear eradication and control.**—*Bull. Tex. agric. Exp. Sta.* 575, 55 pp., 29 figs., 1939.

The authors state that prickly pear [*Opuntia* spp.] in Texas is subject to infection by anthracnose or shot hole (*Gloeosporium lunatum*) [*R.A.M.*, v, p. 303], which, under humid conditions in spring, causes extensive destruction of the young growth. The fungus often effects entry through holes from which the cactus midge (*Asphondylia opuntiae*) has emerged, or it may penetrate through abrasions on the joints. It is also carried by the cactus stink bugs (of which the chief species is *Chelindea vittiger*) from plant to plant and can set up infection wherever the conditions are favourable.

Virusforschung und Viruskrankheiten. Vorträge der Pflanzenschutztagung der Biologischen Reichsanstalt am 2. Februar 1939. [Virus research and virus diseases. Papers read at the Plant Protection Conference of the Reich Biological Institute on 2nd February, 1939.]—*Mitt. biol. Anst.* (*Reichsanst.*), *Berl.*, 59, 92 pp., 50 figs., 14 graphs, 2 diags., 2 maps., 1939.

This is a collection of papers read at the annual conference of the Reich Biological Institute, Dahlem, Berlin, prefaced by E. Riehm.

E. PFANKUCH (pp. 9–12) describes a method of detecting and differentiating plant viruses by measuring the turbidity caused by raw virus juice in solutions of ammonium sulphate. Determinations are made in solutions of 0, 25, and 37·5 per cent. saturation and the ratio of the increase at 25 per cent. saturation to the total increase (at 37·5 per cent.) is expressed as a percentage and termed the so-called turbidity factor. It appeared that the turbidity factor of healthy tobacco juice was considerably lower (average 13 per cent.) than that of mosaic-infected (average 91 per cent.), even when the latter was diluted 1:2 (88 per cent.). Tobacco mosaic virus and two strains of the potato X virus were clearly distinguished by this method, showing not only different turbidity factors, but significantly different curves of turbidity increase. The author expresses the view that this method should also prove adaptable for the quantitative determination of viruses.

The studies by G. A. KAUSCHE (pp. 15–23) on the reactions of tobacco mosaic and potato X viruses to colloidal gold and the formation of hexagonal tobacco mosaic virus crystals *in vitro* have been already noticed from other sources [*R.A.M.*, xviii, pp. 266, 481].

E. KÖHLER (pp. 25–34) discusses the chief problems of virus resistance in plants, such as hypersensitivity and protective inoculation; most of the information has already been noticed in this *Review*.

W. MAIER (pp. 49–60) presents the results of his observations on the symptoms of 'Reisigkrankheit' [or court-noué: ibid., xviii, pp. 294, 510, 652] and leaf roll disease [loc. cit.] of the vine, which are probably caused by viruses. 'Reisigkrankheit' is characterized by short internodes, which were found to be particularly numerous near the

tenth internode, and by double nodes, particularly numerous near the eleventh. Distinct colour reactions were obtained in iodine dye tests: the deep blue colour disappeared after 10 to 20 minutes from iodine-treated expressed sap of vines suffering from the 'reisig' disease, while in sap of healthy vines the discoloration only began after 25 minutes and was completed after many hours. Similarly, the disappearance of colour in the iodine-treated sap of vines affected with leaf roll was more rapid than in that of healthy vines (ten minutes as against several hours).

W. Kotte (pp. 61–64) makes some observations on fern-leaf of tomato in Baden [ibid., xvii, p. 354] and states that the disease has also been reported by Wenzl from Vienna. He describes a ring spot disease of the pods of beans [*Phaseolus vulgaris*] of the Captain Weddingen variety, observed in 1937 in a field near Heidelberg. The spots were greyish-green to brown and necrotic, and the surrounding tissue was slightly depressed. The leaves of diseased plants showed no spots, but they dried up and died prematurely. *Fusarium solani* var. *martii* [ibid., xviii, p. 291] was found at the stem bases and is believed to be a secondary invader, though possibly responsible for the leaf drop. E. Köhler transmitted the ring spot disease by inoculation to Samson tobacco and identified the symptoms as those of the tobacco ring spot virus. This is believed to be the first record of the occurrence of this virus on bean pods in nature.

C. Kaufmann (pp. 65–72) states that the most important virus disease of crucifers in Germany [ibid., xvi, p. 10] is not identical with either of the three types described by Tompkins [ibid., xvii, p. 6, 151, 574; xviii, p. 427]. It appears on spring-sown swedes in July as light green spots and lesions on young and later on older leaves. The young leaves formed after the appearance of the disease are smaller than normal and often curled at the margins, which frequently become necrotic. As the number of affected leaves becomes greater the growth of the roots is gradually reduced and finally arrested altogether. Many of the affected leaves die and fall long before the harvest. The disease occurs in a mild form on colza (*Brassica napus* [*B. campestris*] *oleifera*) and summer-sown swedes, retarding the growth of the plant without destroying it, and very severely on rape (*B. rapa oleifera*), usually killing the plant in the autumn or early winter; it also affects turnips. The percentage of diseased plants was smaller in summer crops sown later than usual, possibly because the optimum development of the disease occurs at relatively high temperatures, at which the incubation period is considerably shortened. The losses caused by this disease in Schleswig-Holstein, where hundreds of square kilometres were severely affected, show it to be far more injurious than any virus disease previously described on crucifers. In the greenhouse it was successfully transmitted by infected juice to radishes and charlock (*Sinapis arvensis*) [*B. sinapis*]. It has been observed in Germany in the provinces of Schleswig-Holstein, Mecklenburg, Oldenburg, Brandenburg, Rhineland, Lippe, Westphalia, and Silesia, and has probably been present, but overlooked, in other parts of the country. There is a striking difference in the susceptibility of swedes of different varieties and origins, the white varieties (Heinkenborstel, East Mark White, Pomeranian

Tankard) being generally more resistant than the yellow (Seefeld, Bangholm Herning) with the single exception of the yellow Vogesa, which is practically immune.

SMITH (K. M.). **The study of plant viruses with special reference to their insect-relationships and some comparisons with the animal viruses.**—*Trans. R. Soc. trop. Med. Hyg.*, xxxii, 5, pp. 557–566, 5 figs., 1939.

This is a general survey of the knowledge at present available concerning plant viruses (of which 163 are stated to have been already placed on record), their transmission by insects, and certain parallels with animal viruses. The paper (read before a meeting of the Royal Society of Tropical Medicine and Hygiene on 19th January, 1939) was followed by a discussion (pp. 566–574).

WYCKOFF (R. W. G.). **Purified viruses and virus proteins.**—*Ergebn. Enzymforsch.*, viii, pp. 1–12, 1939.

This is a critical review of recent important developments in the study of purified viruses and their proteins, many of the papers to which reference is made having been noticed from time to time in this *Review*.

MAGROU (J.). **Les protéines-virus cristallisables.** [Crystallizable virus proteins.]—*Rev. Path. vég.*, xxvi, 2, pp. 109–123, 1939.

In this paper the author reviews and discusses recent investigations by Stanley, Bawden, Pirie, and others [all of which have been noticed in this *Review*] on the nature of the crystalline proteins associated with virus diseases and their possible identity with the viruses themselves.

THATCHER (F. S.). **Osmotic and permeability relations in the nutrition of fungus parasites.**—*Amer. J. Bot.*, xxvi, 6, pp. 449–458, 10 figs., 1 graph, 1939.

A study, by means of plasmolytic methods, was carried out on the osmotic pressure and permeability relationships between fungi and hosts, using *Uromyces fabae* on peas, *U. caryophyllinus* on carnation, and *Botrytis cinerea* and *Sclerotinia sclerotiorum* from decaying celery petioles. Osmotic values were determined for the germ-tubes of the uredospores and haustoria of the rusts, the hyphae of the other two fungi, and for host tissues. The results showed that in all cases the osmotic pressure of the fungus was greater than that of its host. In the plants infected by the two rusts, infection increased the permeability of the plasma membrane of the host cells. Increased permeability was also noted in celery tissue some distance away from cells killed by *B. cinerea* or *S. sclerotiorum*.

Discussing these data with reference to the nutrition of the rust fungi, the author points out that the fungus, with its higher osmotic pressure, can remove water from neighbouring parenchyma cells and even maintain turgor in contact with non-turgid host cells or their free sap. The increase in permeability of the host cells, probably caused by some secretion of the parasite, permits some of the vacuolar solutes to become available to the fungus. The outward flow of water and

vacuolar solutes from the host cells will be checked when the wall tension balances the effective osmotic pressure, so that the cells do not lose turgor completely and consequently remain alive. Both *B. cinerea* and *S. sclerotiorum* in tissues as yet unaffected by their pectinase secretion show the same type of relationship as do the rusts, but the increased permeability of the host cells ultimately proves fatal. In the rusts the factor governing the increased permeability of the host cells is reduced in intensity.

STEINBERG (R. A.). **Growth of fungi in synthetic nutrient solutions.**—*Bot. Rev.*, v, 6, pp. 327–350, 1939.

The author sums up the available information on the carbon, nitrogen, mineral, and some organic requirements for the growth and reproduction of various fungi in culture on the basis of the pertinent literature [of which a bibliography of 99 titles is appended].

KÖHLER (E.) & HEINZE (K.). **Zur Methodik der vergleichenden Sortenprüfung auf Y-Virus-Resistenz bei Kartoffeln.** [A contribution to the technique of the comparative varietal testing of Potatoes for resistance to the Y virus.]—*Züchter*, xi, 7, pp. 169–174, 1 diag., 1939.

In order to avoid the fluctuations in intensity of infection liable to occur over small areas, the writers, in their preliminary tests on the varietal reaction of potatoes to virus Y at the Biological Institute, Dahlem, Berlin, in 1937 [*R.A.M.*, xviii, p. 409], spaced the trial plants at regular intervals throughout the plots, interspersed with thoroughly infested tubers of a susceptible variety. So heavy was the infestation of the aphid vector of the disease (*Myzus persicae*) during the season of the experiments that up to 5,400 insects were counted on one plant. By this means it was ascertained that Bodenkraft is superior to Stärkereiche in respect of resistance to the Y virus. In other tests Johanssen was more resistant than Stärkereiche and Fürstenkrone than Erdgold.

MULLER (H. R. A.). **Onderzoekingen over Aardappelziekten.** [Studies on Potato diseases.]—*Meded. alg. Proefst. Landb., Batavia*, 33, 22 pp., 1939. [English summary.]

Field observations in Java are stated to have shown that the potato disease caused by *Colletotrichum atramentarium* [*R.A.M.*, xvii, p. 60] does not constitute a serious danger to the crop except when the seed tubers are shipped too late in the season, or are weakened by adverse physiological conditions. Under appropriate storage conditions the damage is also slight, but where the temperature and atmospheric humidity are allowed to rise unduly, tuber rot may be stimulated. Even 100 per cent. diseased tubers, however, will produce a practically sound crop, and in the light of the information gained from these experiments the drastic quarantine measures enforced at the time of the first outbreak of *C. atramentarium* in the Dutch East Indies have been revised to admit the importation of early harvested consignments shipped before sprouting.

In trials with Eigenheimer and Bevelander potatoes, both relatively

resistant to blight (*Phytophthora infestans*), Bevelander, also highly resistant to virus diseases, was particularly valuable in areas where the regular renewal of seed by importation is impracticable on economic grounds. The blight-resistant Robijn having proved exceptionally susceptible to slime disease (*Bacterium solanacearum*), showing 32·9 per cent. infection in a propagation area compared with 2·2, 0·7, and 0·2 for Record, Populair, and Nationaal, respectively, the distribution of this variety has been discontinued.

[This paper also appears in *Landbouw*, xv, 4, 1939, and as *Meded. Inst. PlZiekt., Buitenzorg*, 93, 1939.]

LIMASSET (P.). **Recherches sur le Phytophthora infestans (Mont.) de Bary.** [Researches on *Phytophthora infestans* (Mont.) de Bary.]—*Ann. Épiphyt.*, N.S., v, 1, pp. 21–39, 3 figs., 1939.

In studies on potato blight (*Phytophthora infestans*) carried out at Versailles, the author planted on 26th April, 1938, 291 healthy Early Rose tubers together with 31 of the same variety and six of Bintje inoculated by immersion in a conidial suspension of the fungus (infection plot 1), the inoculated Early Rose tubers being interspersed at regular intervals throughout the plot and the Bintje tubers being planted in one area each next to a healthy Early Rose tuber. In a second plot (infection plot 2) the author planted on 3rd May healthy Saucisse tubers and four infection centres of Early Rose (one of naturally infected tubers) together with one of artificially inoculated Saucisse plants.

Blight appeared in plot 1 on 29th July, when plants from five inoculated tubers growing under the shade of poplars showed infection, as did a certain number of neighbouring plants. The disease spread on 30th July but from 1st August it regressed owing to the dry weather. In plot 2 it appeared on 28th July and spread to a number of plants round each infection focus, and after 10th August the attack was general.

The results showed that seed pieces can be an important source of infection. This was demonstrated both by the plants from artificially inoculated and naturally infected seed tubers, whilst potatoes in the surrounding country remained entirely healthy. Further data indicated that the presence of foci of diseased plants permits the development of localized epidemics even when meteorological conditions are unfavourable to infection. This is explained by the author as due to the great abundance of conidia capable of taking advantage of favourable microclimatic conditions.

From the behaviour of the fungus on the two varieties it was deduced that the amount of infection that develops depends not only on susceptibility, i.e., physiological aptitude to harbour the parasite, but on receptivity, which is conditioned both by susceptibility and microclimatic factors. Two plants of equal susceptibility may show widely different receptivity, for instance, Early Rose is quite as susceptible as Saucisse but much less receptive, as its aerial parts are much less luxuriant and create a less favourable microclimate.

At harvest the plants from the inoculated tubers gave a smaller yield than those from healthy ones, even when no infection was present on the foliage, and sometimes the yield from diseased tubers was only

half that from healthy seed. The diseased plants from healthy tubers showed no decline in yield.

From June to August, inclusive, Beaumont's two weather conditions for infection [*R.A.M.*, xvi, p. 514] were not satisfied, but the disease continued to spread even though humidity was under 75 per cent.

Inoculations with a conidial suspension on separate leaves of Early Rose potatoes in Petri dishes showed that at 20° C. (humidity at saturation) the incubation period was three days, conidiophores appearing two days later. At 17° the corresponding periods were four days and 24 or 48 hours, while at 25° the incubation period was somewhat longer than at 20°. When the inoculations were made at 10° and the subsequent temperatures ranged from 4° to 16°, the incubation period was six days.

Schaal (L. A.). **Penetration of Potato-tuber tissue by Rhizoctonia solani in relation to the effectiveness of seed treatment.**—*Phytopathology*, xxix, 8, pp. 759–760, 1 fig., 1939.

Eleven out of 32 cultures from the periderm tissue underlying large, non-viable sclerotia of *Rhizoctonia* [*Corticium*] *solani* on potato seed pieces treated in Maine with ordinary or acidulated mercuric chloride [*R.A.M.*, xviii, p. 577] gave rise to the fungus, indicating the possibility (subsequently confirmed by the examination of stained sections) that the mycelium had penetrated the tissues to a depth inaccessible to disinfectants. Invasion was found to be mostly intercellular and to extend through several cell layers; in one section the mycelium (which had presumably entered through a lenticel) had traversed the cork cambium and entered the tissues below the periderm. In such a site it would be protected from complete destruction by antiseptics, a fact that may account for the presence of some infection on treated seed potatoes.

Cralley (E. M.). **Effects of fertilizer on stem rot of Rice.**—*Bull. Ark. agric. Exp. Sta.* 383, 17 pp., 1 fig., 1939.

In field trials on the control of stem rot of rice (*Leptosphaeria salvinii* [*R.A.M.*, xvii, p. 128] and *Helminthosporium sigmoideum* var. *irregulare* [ibid., xv, p. 47; xvi, p. 156]), carried out during the years 1936 to 1938 in Arkansas, significant increases in yield resulted from applications of various amounts of nitrogen or phosphorus, but both fertilizers increased the severity of the disease. The effects both on the yield and disease incidence were slightly greater with nitrogen than with phosphorus, and were intensified when the two were applied together instead of separately. Applications of potassium, on the other hand, although of little influence on the yield, did not increase the severity of the disease, and when applied in combination with nitrogen and phosphate (for instance, 600 lb. fertilizer, composed of 6 parts of ammonium sulphate, 8 of superphosphate, and 24 of potassium sulphate per acre, two months after planting) had the beneficial effect of maintaining the intensity of the disease on a level equal to or sometimes below that of the control plots. The addition of sufficient potassium to fertilizers is, therefore, important on stem rot-infested land. The results of sand culture experiments with *L. salvinii* in the greenhouse in general substantiated

those obtained in the field. Plants grown in solutions with high nitrogen and low potassium contents showed a high degree of infection, while on plants grown in solutions with a constant nitrogen and phosphorus content the severity of the disease diminished as the potassium content of the solution was increased.

Beeley (F.) & Baptist (E. D. C.). **Palm oil diluent for tar oil fungicides and its effect on bark renewal of Hevea.**—*J. Rubb. Res. Inst. Malaya*, ix, 1, pp. 40–50, 1939.

Experiments are fully described, with a special fungicidal oil [unspecified] of three grades, which, diluted with palm oil, was intended by the manufacturers to control bark disease of *Hevea* rubber and stimulate bark renewal. It was found that the application of controlled quantities of palm oil alone to the freshly tapped bark of old, hard-barked rubber trees very significantly improved subsequent bark renewal owing, it is thought, to the presence of growth hormones in the oil. The use of the fungicidal oils with the palm oil was of no added advantage, except in the control of panel diseases. At strengths of 5 to 10 per cent. the fungicidal oil in palm oil made a suitable mixture for the control of mouldy rot *Ceratostomella fimbriata* [*R.A.M.*, xviii, p. 342], and also promoted bark renewal. The disadvantages accruing from the application of excessive amounts of palm oil to the panel can be obviated by avoiding overlapping in subsequent treatments of a section already treated.

Beeley (F.). **Oidium heveae. A report on the 1939 outbreak.**—*J. Rubb. Res. Inst. Malaya*, ix, 1, pp. 59–67, 1939.

In the north of Malaya, refoliation of *Hevea* rubber in January and February, 1939, was nearly complete before dull weather set in, with the result that there was practically no infection by *Oidium heveae* [*R.A.M.*, xviii, p. 272]. In the central areas, and at the foot of higher hills, wintering was sufficiently delayed to favour mild infection in late-wintering trees, the first blossom being seriously affected. In more southerly districts, refoliation proceeded in bright weather with occasional showers, and there was no serious loss due to infection. Sulphur dusting in various localities was abandoned or curtailed, only two or three applications being made. The fact that infection appeared within 48 hours of the onset of dull weather supports the view that *O. heveae* hibernates in the buds, and that as these open the mycelium, favoured by dull, cool, humid conditions, produces an early crop of conidia which rapidly become disseminated.

Murray (R. K. S.). **Oidium leaf disease in Ceylon in 1939.**—*Quart. Circ. Ceylon Rubb. Res. Scheme*, xvi, 2, pp. 81–88, 1 graph, 1939.

During 1939 *Oidium* [*heveae*: *R.A.M.*, xvii, p. 770] is stated to have caused considerable damage in certain low-country localities in Ceylon following spells of very dry weather. The disease is believed to have been favoured by exceptionally low night temperatures in January and February, which were apparently not offset by high day temperatures, and unusually high atmospheric humidity in the early morning, recurring despite the dry weather. Sulphur dusting was extremely

successful in the Matale district in the low country, but the results on other estates in a similar situation were disappointing. Spells of cold weather being abnormal in January and February, it is not considered necessary to modify the present recommendations for dusting, but such spells should be recognized as a warning that a severe outbreak of the disease may follow, and the first application of sulphur consequently be made at the relatively high rate of 5 to 6 lb. per acre. It is suggested that dusting programmes should be made more elastic by adjusting them to weather conditions and the elevation of the estate.

Kanivets (I. I.). **Biochemical methods of creating in soils a resistant texture and their function in the increase of Beet crop yields.**—*Chemisat. socialist. Agric.*, vii, 6, pp. 51–60, 1938. [Russian. Abs. in *Chem. Abstr.*, xxxiii, 19, p. 7941, 1939.]

In experiments in the U.S.S.R. the introduction into the soil of *Trichoderma lignorum* was found to strengthen the texture, increase the moisture content, and improve the nutritional condition and aerial development of plants. The sugar beet, wheat, and oats yields were augmented, with a rise in the sugar content of the first-named of 0·5 to 1 per cent. *T. lignorum* further stimulates the growth of *Azotobacter*. These beneficial effects were intensified by the simultaneous incorporation in the soil of *Aspergillus niger*.

Powers (W. L.). **Boron as a fertilizer for Western Oregon soils.**—*Science*, N.S., xc, 2324, pp. 36–37, 1939.

Recent experiments by the author in Oregon showed that yellow top of lucerne could be controlled and yield strikingly increased on various soils by applications of boric acid at the rate of 30 lb. an acre [*R.A.M.*, xvii, p. 398]. Similar treatment [amount unspecified] also controlled the nutritional deficiency diseases surface canker of table beets [cf. ibid., xvii, p. 718] and stem crack of celery [ibid., xvi, p. 792]. Boron applications to soil around aster [*Callistephus chinensis*], broccoli, and cabbage plants showing bronzing of the tops and cracking at the nodes have given promising results. The beneficial effects of boron on various plants are indicated.

Ware (W. M.). **The nettlehead disease of Hops.**—*J. S.-E. agric. Coll., Wye*, xliv, pp. 41–43, 1939.

The measures at present recommended for the control of nettlehead disease of hops [*R.A.M.*, xviii, p. 654] in England consist in grubbing affected hills as soon as possible after the symptoms appear (in any case, in the same season) and taking no cuttings for propagation from any garden in which the disease has occurred. Strains of Fuggle hops free from nettlehead exist at East Malling, and sets would be raised from them if required.

Ogilvie (L.). **The nettlehead disease of Hops in the Bristol Province.**—*J. S.-E. agric. Coll., Wye*, xliv, pp. 44–46, 1939.

Nettlehead disease of hops [see preceding abstract] is stated to be absent from very few hop gardens in Worcestershire and Herefordshire and to cause very heavy loss in many of them. It is found on Early

Bird, Mathon, Bramling, and Fuggle hops. Roguing must be prompt and efficient, apparently healthy stocks on either side of a diseased one must generally be removed in lightly affected gardens, and rejected material must be burnt.

WARE (W. M.) & GLASSCOCK (H. H.). **The downy mildew of the Hop in 1938.**—*J. S.-E. agric. Coll., Wye*, xliv, pp. 54–58, 1939.

In this account of the hop downy mildew [*Pseudoperonospora humuli*: *R.A.M.*, xvii, p. 838] situation in England in 1938, it is stated that no great damage was caused. This was probably largely due to the weather conditions, the season 1938 being the seventh consecutive one in which rainfall did not exceed the normal in both July and August, while in June the rainfall was subnormal. Where leaf infections occur at more than 2 ft. from the ground in spite of thorough 'spiking', the plants should be sprayed with Bordeaux mixture (5–7½–100) to protect the remaining pairs of leaves near the growing point. As spraying cannot protect the growing point itself, and does not prevent infection of the terminal spikes, all the infected leaves should previously be removed from the bine when this is about 5 ft. high, even if only four pairs of healthy leaves are left near the growing point. During July, the disease was found on wild hops, forming spikes and leaf infections, in three widely separated areas in Aberdeenshire.

RANGASWAMI (S.) & GRIFFITH (A. L.). **A note on the control and eradication of new outbreaks of the spike disease of Sandal (Santalum album).**—*Indian For. Rec.*, N.S., *Silviculture*, iii, 7, pp. 263–290, 6 pl., 4 diags., 1939.

In a study on the spike disease of sandal (*Santalum album*) [*R.A.M.*, xviii, p. 138] the approximate size of the vector was found, in experiments with wire mesh cages, to be about 1/20 to 1/4 in. Furthermore it was proved by exposing pot plants to mass infection by [unidentified] insects, collected during the night on sandal foliage, that the disease is insect-borne. The source of infection was found to be limited to diseased trees, masked diseased trees (i.e., trees during the period between infection and manifestation of symptoms), and to insect vectors, and consequently the disease can be controlled by the elimination of the first two sources, their removal automatically preventing the insect vectors from becoming viruliferous. For the eradication of diseased trees poisoning with Atlas tree killer solution [ibid., xvi, p. 710] was found to be more thorough and economical than extraction. As regards masked trees, it was found that when such plants were defoliated the disease appeared in the new leaves.

The recommendations for the control of the disease [which are fully given, together with an exact description of the symptoms, in an appendix for the use of foresters] are summed up as follows. As soon as an outbreak is reported from an area all spiked trees in it should be killed at once by poisoning, all other sandal trees within the area and in a belt from 100 ft. to two furlongs wide round it should be lopped by removing all branches of 2 in. girth or less, and all trees, in which the disease then becomes manifest, killed. These recommendations proved entirely successful in eradicating the disease (as far as can be judged

after the lapse of periods of up to four years) from eight small areas, where the outbreaks were new and only a few trees affected, while in several large areas, where the disease had been allowed to spread for a number of years before control operations were started, it was confined to its original limits and slowly eliminated from the area. On one large experimental area containing 14,200 sandal trees, 6,337 were either killed at once or lopped and then killed, and no spread of the disease to the adjacent areas has been observed. It was shown that even in large blocks of 300 to 400 acres the spread of the disease can be arrested to a very considerable extent in a comparatively short time. It is stated that since the disease started in the North Salem division (about 26 years ago) the area affected enlarged to approximately 99,500 acres and that the annual loss per tree, as calculated by other workers, amounts to about Rs. 1.55 to 5½. It is concluded that the research on the control of spike has been very remunerative, since the average loss averted by the control operations based thereon already amounts to Rs. 21,000 per annum.

RANGASWAMI (S.) & GRIFFITH (A. L.). **Host plants and the spike disease of Sandal.**—*Indian For.*, lxv, 6, pp. 335–345, 1939.

When sandal [*Santalum album*] plants growing in pots with any of the 27 hosts tested were artificially infected with spike disease [*R.A.M.*, xviii, p. 343, and preceding abstract] by the standard leaf-grafting method it appeared that the incidence of spike was nil in plants growing on certain hosts (e.g., *Azadirachta indica*, *Strychnos nux vomica*, *Dalbergia sissoo*, and five others), and varied from very low (e.g., *D. latifolia*) to complete incidence (e.g., pigeon pea and *Melia azedarach*) in others. These results indicate that some host plants impart a high degree of relative resistance to spike to sandal plants parasitic on them. This conclusion was confirmed when sandal plants grown on 26 different hosts [which are listed] were exposed to natural infection in the forest. In one small-scale experiment, subplots of one acre, each containing 200 sandal plants, were treated by removing (*a*) all except resistant hosts and introducing other resistance-imparting species, and (*b*) all except susceptible hosts and supplementing these by similarly susceptible species. After six years the incidence of spike in the treated areas was in the proportion of 1:4. In a further experiment with five-acre subplots treatment as for (*a*) and (*b*) was supplemented by an untreated control plot (*c*). After seven years spike occurred in the proportion of 0:32:12. It is concluded from these results that the use of resistance-inducing as well as economically profitable hosts of sandal in new plantations should prove of great practical value in reducing the incidence of spike.

SYDOW (H.). **Beschreibungen neuer südafrikanischer Pilze—VII.** [Descriptions of new South African fungi—VII.]—*Ann. mycol., Berl.*, xxxvii, 3, pp. 181–196, 1939.

Latin and German diagnoses are given of seven new species of fungi collected in South Africa [cf. *R.A.M.*, xiv, p. 793], including *Pseudothyridaria moroides*, forming isolated, narrowly striate, longitudinal, tapering weals or galls, up to 13 mm. long, on living twigs of *Rubus pinnatus*; and *Diatrypella agaves* on dying peduncles of *Agave americana*.

Sydow (H.). **Novae fungorum species—XXVII.** [New species of fungi —XXVII.]—*Ann. mycol., Berl.*, xxxvii, 3, pp. 197–253, 1939.

In this further list [cf. *R.A.M.*, xviii, p. 56] of 45 new species of fungi (mostly from Africa) are included Latin and English diagnoses of three collected by F. C. Deighton in Sierra Leone, viz., *Balladynella palmicola*, occurring on greyish-green, occasionally yellow to brownish, scattered, elliptical or irregular lesions, up to 10 by 8 mm., on living leaves of oil palm, *Mycosphaerella spilota* on living or withered foliage of *Andropogon tectorum*, and *Asterina manihotis* on the foliage of *Manihot glaziovii*.

Verplancke (G.). **Note sur quelques Ascomycètes nouveaux pour la flore belge.** [A note on some Ascomycetes new for the Belgian flora.]—*Bull. Jard. bot. Brux.*, xv, 3, pp. 333–344, 1939.

An annotated list is given of 25 Ascomycetes new to the Belgian flora, from herbaria of the Botanical Gardens, Brussels. *Sphaerella* [*Mycosphaerella*] *sentina* on pear leaves is transferred to *Phaeosphaerella* as *P. sentina* n. comb.

West (E.). **Notes on Florida fungi.**—*Mycologia*, xxxi, 4, pp. 423–432, 3 figs., 1939.

This is an annotated list of 20 fungi collected in Florida, including *Uromyces indigoferae* on *Indigofera tinctoria* and *I. suffruticosa*, believed to be recorded for the first time from the United States.

Garrett (O. A.). **The Ustilaginales or smuts of Utah.**—*Bull. Utah Univ.*, Biol. Ser., iv, 4, 23 pp., 4 pl., 1939.

This is an annotated list of 42 smuts collected (mostly by the author) in Utah since 1902. Keys to the families and genera and fungus and host indexes are provided.

Mix (A. J.). **Mycelial habit in some species of Taphrina.**—*Mycologia*, xxxi, 4, pp. 445–454, 2 figs., 1939.

Eight species of *Taphrina* [*R.A.M.*, xviii, p. 141] parasitic on ferns or monocotyledons, including two new to science, were found to form mycelium within the outer wall of the epidermal cell of the host, and to produce ascogenous cells and asci in a locule of the epidermal wall.

Groves (J. W.) & Drayton (F. L.). **The perfect stage of Botrytis cinerea.**—*Mycologia*, xxxi, 4, pp. 485–489, 1 fig., 1939.

About 70 isolates of *Botrytis cinerea* from various hosts and localities were used in attempts to obtain a perfect stage of the fungus. The technique used was the same as that previously described by Drayton [*R.A.M.*, xvi, p. 750], but the spermatization was achieved by applying the spermatial suspension directly to the sclerotia or to sterilized soil, which was then placed over the sclerotia; the process was delayed for a fortnight after moving the cultures from 0° to 5° C. and they were then kept at 14° for one month prior to their transfer to the greenhouse. Mature apothecia were obtained in nine out of 16 isolates from apples, celery, or potato stems, the first being found about a fortnight after the cultures were moved to the greenhouse and many more developing during

the following six weeks. In single ascospore cultures obtained from these nine isolates very marked differences existed in the rate of growth, sclerotial production, and general appearance. In most cases the cultures which did not produce sclerotia developed abundant spermatia, but all sclerotia-producing cultures formed spermatia as well. No explanation of these variations has yet been found, but it is possible that more than one species was involved. Hence no change in nomenclature is proposed for the present, and it is hoped that the work now in progress with single ascospore cultures will help to interpret the variations observed and to clarify the species concept in this group of fungi.

Sampson (Kathleen). **Olpidium brassicae (Wor.) Dang. and its connection with Asterocystis radicis de Wildeman.**—*Trans. Brit. mycol. Soc.*, xxiii, 2, pp. 199–205, 1 pl., 1 fig., 1939.

From a study of a species of *Olpidium* with stellate cysts found on the roots of *Agrostis* [in Wales] and later obtained from cauliflower seedlings raised in infected soil, of *O. brassicae* from cabbage [from England], and of material supplied by A. W. Bartlett of *O. radicicolum* [*R.A.M.*, viii, p. 282; ix, p. 288] on swedes, the author concludes that all these organisms are identical with *O. brassicae* [ibid., xviii, pp. 139, 483]. Comparison with published records led to the further conclusion that the following species are synonyms: *Asterocystis radicis* [ibid., xviii, p. 550], *O. borzii, O. radicicolum,* and *Olpidiaster radicis* [ibid., viii, p. 282; xvii, p. 415]. A revised description of the fungus is given. The zoosporangia are solitary or aggregated in the host cell, thin-walled, varying from spherical, 12 to 20 μ in diameter, to elongate, 25 to 220 by 20 to 45 μ, opening by one to four exit tubes which vary in length according to the distance from the host surface. The zoospores, 3 μ in diameter, are uniciliate. The resting sporangia (cysts) are usually spherical, 8 to 25 μ in diameter, but may be oval, up to 30 μ in length. The exospore is coarsely wrinkled with ridges up to 3·5 μ in height, showing a stellate form with six to nine points in optical section. The endospore is thin and smooth, free from the exospore.

Hilborn (M. T.) & Linder (D. H.). **The synonymy of Fomes fomentarius.**—*Mycologia*, xxxi, 4, pp. 418–419, 1939.

A list is given of 21 generally accepted synonyms and 5 suspected synonyms of *Fomes fomentarius* (Fries) Kickx, a fungus frequently but incorrectly cited as *F. fomentarius* (L.) Gill.

Subba Rao (M. K.). **Report of the Mycologist, 1937-38. Report of the Mycologist, 1938-39.**—*Adm. Rep. Tea sci. Dep. unit. Plant. Ass. S. India, 1937–38*, pp. 28–37, 1938; *1938–39*, pp. 28–42, 1939.

In the first of these reports [cf. *R.A.M.*, xvii, p. 138] it is stated that the leaf disease of tea caused by *Cercosporella theae* [ibid., xvii, p. 706], first reported from southern India in 1935, became more prevalent in that area in 1937–8, occurring on many estates in the Nilgiris, Wynaads, the Anamallais, and the High Range. The severity of the outbreak appears to have been influenced by the previous condition of the bushes, weak bushes having suffered more than healthy ones. The fungus was also recorded on *Acacia decurrens*, to the foliage of which

it caused much damage, *Albizzia moluccana*, *Poinciana regia*, and *Aleurites* spp.

Only a few inquiries regarding *Corticium invisum* [ibid., xvii, p. 138] were received. Tea leaves are frequently infected by *Asterina camelliae* [ibid., xvii, p. 162], which parasitizes the leaf superficially but does not cause much damage. All the affected leaves examined showed the presence of *Dimerium wattii* parasitizing *A. camelliae.*

Leaf fall of *Grevillea* [*robusta*], associated with a *Pestalozzia* and a *Phyllosticta* [cf. ibid., xviii, p. 713], was noted on some estates in the Nilgiri-Wynaad, the chief feature being defoliation of the growing shoot, while the older leaves were not much affected. The similarity of the *Phyllosticta* with that associated with leaf fall of *G. robusta* in Ceylon was confirmed by C. H. Gadd.

Cardamom [*Elettaria cardamomum*] is locally affected by mosaic [ibid., xviii, p. 89], and during the period under review was attacked by a rhizome rot associated with *Rhizoctonia* [*Corticium*] *solani* and eel-worm (probably *Anguillulina*), the plants showing a damping-off effect, with most of the aerial growth collapsing at ground-level.

In the second report it is stated that tea black blight (*Asterina camelliae*) appeared to have spread in 1938–9 to areas previously unaffected. The fungus was observed to attack bushes towards the end of the pruning cycle and during the rainy season; in the subsequent dry weather none of the affected bushes showed any serious after-effects.

Tea die-back and canker is constantly associated with *Nectria subquaternata*, which is regarded as the cause of the disease, though inoculations with this fungus were unsuccessful. Affected branches show numerous gnarled cankers along their length, continuously or in patches, while the bark turns dirty brown, and is ruptured on the surface. Finally the leaves die. The symptoms are most evident in dry weather. The branches attacked are not thicker than a pencil, and both green shoots and red wood are susceptible. Generally injury seems to begin at leaf scars, but infection may start at wounds caused by plucking or tipping, or at branch axils. The cankered areas are weak, and infected shoots, when dry, break off readily. A conidial form, definitely established as belonging to *N. subquaternata*, appeared on the diseased shoots after the beginning of the rains. Descriptions are given of both stages of the fungus.

Die-back of tea shoots and pruned branches due to *Megalonectria pseudotrichia* and its conidial form *Stilbum cinnabarinum* [ibid., xvii, p. 299] caused slight damage. It is recommended that the affected shoots should be cut back to the new wood.

Die-back of tea shoots after pruning, due to *Leptothyrium theae* [ibid., xv, p. 747], was first observed in southern India in April, 1938, on an estate in the High Ranges, and since that date has been found in the Vandiperiyar District and South Travancore. The fungus attacks young shoots that develop after pruning, the foliage becoming yellow and gradually turning brown and dying; green shoots also turn brown. The disease is not at present serious, but may become more important if uncontrolled.

The leaf fall of *G. robusta* referred to in the earlier of these reports was recorded during 1938–9 at an altitude of nearly 4,500 ft., though

until recently confined to the lower elevations. This rapid spread caused alarm on estates where shade presents a difficult problem. Incidence has been severe. Australian authorities, upon being consulted, stated that in Australia the disease occurs in forest nurseries, but can be controlled by two applications of Bordeaux mixture (3–4–40) applied at an interval of a fortnight.

Hevea rubber mildew [*Oidium heveae*: ibid., xviii, p. 500] was recorded in southern India in 1936–7, and appears to be spreading to new areas.

KUNKEL (L. O.). **Movement of Tobacco-mosaic virus in Tomato plants.**—*Phytopathology*, xxix, 8, pp. 684–700, 2 figs., 1939.

In experiments at the Rockefeller Institute for Medical Research, 44 hours was the minimum period for the initiation of the movement of the tobacco mosaic virus out of inoculated Bonny Best tomato leaflets. On first reaching the stem, the virus generally moved both upwards and downwards, though occasionally its passage was in one direction only. No evidence was forthcoming that the virus traverses the roots on its way from an inoculated leaf to the tip of the plant, and in certain individuals, at any rate, this course was definitely not followed. Once movement from an infected leaflet begins the virus travels rapidly, covering a distance of 7 in. or more per hour in some cases. Samuel's observation that in the first stages of entry into the stem the virus particles may be separated by considerable distances [*R.A.M.*, xiii, p. 476] was fully confirmed by these experiments. The particles have to pass through long chains of cells before infection is established, so that propagation by means of an autocatalytic reaction cannot be involved in this process. Virus particles, after remaining for some time in a dormant condition in sections of tobacco or tomato stems, may move out into plants arising from such sections and there multiply and cause infection. Observations on the development of mosaic in a plant of *Abutilon striatum* [ibid., xvi, p. 130] after an apparent cure persisting for seven months suggest that in rare instances particles of this virus may also lie dormant in the plant.

WALLACE (J. M.). **Recovery from and acquired tolerance of curly top in Nicotiana tabacum.**—*Phytopathology*, xxix, 8, pp. 743–749, 4 figs., 1939.

In this expanded account of the writer's experimental observations in California on the recovery of Turkish tobacco from beet curly top and the acquisition by the host of tolerance of the virus [*R.A.M.*, xviii, p. 142], it is stated that the infective principle was detected in recovered plants of the fourth vegetative generation. The phenomena of recovery and acquired tolerance in tobacco affected by curly top are comparable in many ways to those reported for tobacco ring spot [ibid., xv, p. 831] and tomato curly top [ibid., xviii, p. 64], and it is suggested that such material affords an excellent opportunity for the study of immunology in plants.

KOCH (L. W.). **The present status of the Tobacco root rot problems in Ontario.**—*Lighter* (*Dep. Agric., Can.*), ix, 3, pp. 18–20, 1939. [Mimeographed.]

Brown root rot of tobacco in Ontario [*R.A.M.*, xvi, p. 637; xvii,

p. 774], which is attributed to a toxin or toxins, perhaps in association with micro-organisms, differs in some important particulars from the disease given the same name in the United States [ibid., xviii, p. 715]. In Ontario, the disease is most prevalent and severe on the light, sandy soils of Essex County, and the most extensive injury has consistently been noted on Burley tobacco, though damage also occurs on flue-cured and dark tobaccos. The condition may be materially reduced in the flue-cured crop by growing the more resistant varieties, such as White Mammoth, Bonanza, or Duquesne, provided that black root rot (*Thielaviopsis basicola*) is not also present, or in the Burley crop (with the same proviso) by growing Kelley or Judy's Pride. Brown root rot has consistently caused the greatest amount of damage when maize or soy-bean immediately preceded tobacco in the rotation. When other conditions favour the disease, it often varies in direct proportion to the number of successive crops of maize or soy-bean preceding the tobacco.

While true resistance to *T. basicola* is not shown by any flue-cured tobacco in Ontario, Yellow Mammoth and a strain of Gold Dollar show a considerable degree of resistance; so far, Harrow Velvet has proved to be the only resistant Burley variety, and has been found very satisfactory in other respects. The evidence indicates that the longer the rotation the greater the freedom from *T. basicola*, provided that the intervening crops are not hosts of the fungus. Under ordinary conditions, a four-year rotation on the lighter soils has satisfactorily checked damage from *T. basicola* on susceptible varieties.

PORTE (W. S.), DOOLITTLE (S. P.), & WELLMAN (F. L.). **Hybridization of a mosaic-tolerant, wilt-resistant Lycopersicon hirsutum with Lycopersicon esculentum.**—*Phytopathology*, xxix, 8, pp. 757–759, 1 fig., 1939.

The wild South American *Lycopersicum hirsutum* has been found to be highly resistant to wilt (*Fusarium bulbigenum* var. *lycopersici*) [see above, p. 788] and apparently completely tolerant of tobacco mosaic, the latter character not having previously been observed in any of the *L.* species on varieties tested by the writers. Crosses between the species and Marglobe and Bonny Best tomatoes have been made and are being developed.

BLOOD (H. L.). **Breeding technique for disease-resistant Tomatoes. Study of suitable varieties for Pacific Coast and Intermountain State.**—*West. Cann. Pack.*, xxxi, 2, p. 50, 1939. **Breeding disease-resistant Tomato varieties for the Intermountain States and the Pacific Coast.**—Nat. Cann. Ass., Wash., 2 pp., 1939 [mimeographed]. **Breeding disease resistant Tomato varieties. 2. For the Intermountain States and Pacific Coast.**—*Canner*, lxxxviii, 12, pp. 87–88, 1939. [Abs. in *Plant Breed. Abstr.*, ix, 4, p. 477, 1939.]

Resistance to curly top is stated to have been shown by about 19 tomato [*R.A.M.*, xv, p. 123] selections (including the green-fruited *Lycopersicum hirsutum*) of South American, Mexican, and hybrid origin in trials in Utah, where an intensive breeding programme has been planned to transfer this character to commercial varieties. Another green-fruited species from South America, *L. peruvianum*, is highly

resistant to *Fusarium* [*bulbigenum*] var. *lycopersici* [see preceding abstract]. A certain degree of resistance to wilt (*Verticillium*) [*albo-atrum*] has been incorporated in the Californian-bred Riverside tomato [ibid., xvii, p. 139], while the same quality in a very pronounced form is typical of a Peruvian wild strain which is also being used in breeding experiments. Forms combining resistance to spotted wilt [ibid., xviii, p. 439] with desirable commercial qualities have been obtained by D. W. Porter in the F_6 of the cross *L. pimpinellifolium* × Marglobe. Resistance to mosaic has not yet been developed to any noteworthy extent.

D'Oliveira (Maria de L.). **Inoculações experimentais com o Bacterium savastanoi E. F. Smith e o Bacterium savastanoi var. fraxini N. A. Brown.** [Experimental inoculations with *Bacterium savastanoi* E. F. Smith and *Bacterium savastanoi* var. *fraxini* N. A. Brown.]—*Agron. lusit.*, i, 1, pp. 88–102, 2 pl., 1939. [English summary.]

A tabulated account is given of cross-inoculation experiments at the Botany School, Cambridge, and the Almeida Phytopathological Laboratory, Lisbon, with *Bacterium* [*Pseudomonas*] *savastanoi*, isolated from olives in Portugal, and *Bact. savastanoi* var. *fraxini* [*P. fraxini*: *R.A.M.*, xviii, p. 560] from ash in the Cambridge district. The former was found to be much more active than the latter outside its natural host, inducing typical galls on *Forsythia viridissima*, *F. intermedia*, and *Fraxinus angustifolia*, and rough overgrowths arising from cell proliferation along the veins of *Phillyrea media* leaves. The ash organism, on the other hand, failed to produce true cankers on plants outside the genus *Fraxinus*, though it caused slight necrosis on olives, persistent necrosis, sometimes accompanied by girdling, of *Forsythia intermedia* twigs, and moist scabs on privet (*Ligustrum japonicum*), *F. viridissima*, and *F. suspensa*. It would thus appear that both the organisms under observation tend to produce the same type of infection as on the original hosts.

The ash trees referred to above also developed proliferating cankers from which was isolated a fungus identified by J. Ehrlich as *Cylindrocarpon mali* or its var. *flavum* [*Nectria galligena* or its var. *major*: ibid., vii, p. 677].

Day (W. R.). **Root-rot of Sweet Chestnut and Beech caused by species of Phytophthora. II. Inoculation experiments and methods of control.**—*Forestry*, xiii, 1, pp. 46–58, 1939.

In continuation of his studies on the root rot disease of sweet chestnut and beech [*R.A.M.*, xviii, pp. 282, 355], the author demonstrated in inoculation experiments from 1932 to 1937 that these trees and *Castanea crenata* (a species not grown in Great Britain, but reported as highly resistant to root rot from France and elsewhere), are all susceptible to *Phytophthora cambivora*, *P. syringae*, and *P. cinnamomi*, *C. crenata* and beech being rather less susceptible than sweet chestnut to *P. cinnamomi*, while *C. crenata* is possibly the more resistant to *P. syringae*. Field observations indicated that beech is more resistant to both *P. cambivora* and *P. cinnamomi* than sweet chestnut. Oak trees,

though successfully inoculated, were only slightly affected by *P. cambivora*, while elm and *Nothofagus* spp. were both susceptible to attacks by this species. Plants of *C. crenata* raised for trial purposes were found to suffer from frost injury; their resistance to root rot is not yet known in the field.

The control of *Phytophthora* root rot in Great Britain is considered to depend mainly on the avoidance of heavy water-retentive or badly drained soils. Sweet chestnut should preferably be planted on light, well-drained, non-calcareous loams of at least moderate fertility, and beeches on dry heavy soils, such as are commonly derived from clay with flints overlaying chalk. The excision of diseased bark and sterilization of the wound and of the soil may save individual trees in an early stage of infection.

ARNAUD (G.). **La résistance des Ormes à la maladie (Graphium ulmi).** [The resistance of Elms to the disease (*Graphium ulmi*).]—*Ann. Épiphyt.*, N.S., v, 1, pp. 41–49, 2 figs., 1 map, 1939.

Observations at Versailles on 50 young elms of the *Ulmus campestris* type planted in a locality where infection by *Ceratostomella ulmi* [*R.A.M.*, xviii, p. 771] was abundantly present showed that after ten years only two were unaffected. Vigorous trees suffered most. Trees from which the top diseased part of the trunk had been removed remained healthy for a time and sprouted vigorously, but became reinfected in equal proportion to trees infected for the first time. There was no evidence of immunization.

Some objections to the view that the disease is spread by *Scolytus* beetles [*S. scolytus* and *S. multistriatus*: ibid., xviii, p. 557] are brought forward. For example, no damage by these insects was observed on young trees, some of which rapidly became infected. Adult insects were on several occasions observed in a small gallery at the base of healthy branches. A striking disparity was noted between the very large numbers of insects emerging from dead and diseased trees and the few trees that became infected each year. Further, no insects are associated with the closely similar disease caused on *Ailanthus glandulosa* in Paris by *Verticillium dahliae* [ibid., xvii, p. 493].

BUCHWALD (N. F.). **Douglasiens Sodskimmel (Phaeocryptopus gäumanni). En ny svamp paa Douglasgran i Danmark.** [The Douglas Fir soot fungus (*Phaeocryptopus gaeumanni*). A new fungus on Douglas Fir in Denmark.]—*Dansk Skovforen. Tidsskr., 1939*, pp. 357–382, 12 figs., 1939.

An account is given of the symptomatology, morphological characters, taxonomy, course of infection, geographical distribution, origin, and control of *Phaeocryptopus gaeumanni*, first observed on Douglas firs (*Pseudotsuga taxifolia*) [*R.A.M.*, xviii, p. 490] in Denmark in May, 1938; the disease has now been definitely reported from three localities in Zealand and Jutland, trees up to 35 years old being attacked. All three types of the fir—blue (var. *glauca*), grey (var. *caesia*), and green (var. *viridis*)—were involved, but generally speaking, the two first (inland) are much more susceptible than the last-named (maritime). The fungus is believed to have been conveyed to Denmark from England

by the wind; the latter country and Switzerland appear to have acted as the two centres of dissemination in Europe. Appropriate measures have already been adopted in Germany for the gradual replacement of the susceptible blue and grey types by the resistant green, and a similar course should probably be pursued in Denmark.

Peace (T. R.). **Forest pathology in North America.**—*Forestry*, xiii, 1, pp. 36–45, 1939.

This is a general survey of problems confronting forest pathologists in North America, based on a four months' tour, in the course of which the author visited 36 American States and three Canadian provinces. In contrast to the predominantly artificial and pure forests of Great Britain, the American forests are stated to be primarily natural and usually mixed. Minor diseases of young trees are of little importance, but more serious are the epidemic diseases such as *Endothia parasitica* and *Cronartium ribicola*. The greatest immediate danger to American forests is decay, which is causing very high losses among the old trees in the west and among the second- and third-growth hardwoods arisen from seeds or as sprouts from the old stumps in the east, often entering the trees through the wounds caused by surface fires. *Fomes annosus* [*R.A.M.*, xvii, p. 714; xviii, pp. 74, 357] occurs commonly but is not associated with any considerable damage. *Rhabdocline pseudotsugae* [ibid., xviii, p. 491] has so far proved less serious to the Douglas fir (*Pseudotsuga taxifolia*) than in Europe; there are several varieties of the fungus in America varying in the form of fructifications and spores, and probably in pathogenicity. *Adelopus* [*Phaeocryptopus*] *gaeumanni* [see preceding abstract] occurs on the same host over a large area in northwest America but does not cause appreciable injury to the trees. Variation in the Douglas fir is so great that a uniform type of growth or resistance to disease cannot be obtained from seeds collected in any one State or any one forest. Selection of desirable types carried out on individual trees or on very small areas should prove very valuable. *Hypodermella laricis* [ibid., xii, p. 255], common on larch in British Columbia and Idaho, is not considered a serious disease in America but might prove troublesome if brought to Europe. What was apparently a particularly severe and general attack of *Gnomonia veneta* [ibid., xviii, p. 354] on planes [*Platanus*] was experienced during 1938, being particularly conspicuous in some of the river valleys near the Californian coast, where most of the trees were completely defoliated in mid-May. The attacks of this fungus in Great Britain are never so severe and extensive, the same applying to *Physalospora miyabeana* [ibid., xiv, p. 479] and *Fusicladium saliciperdum* [loc. cit.], both of which caused a serious defoliation and die-back of willows in New England. The number of canker-forming fungi occurring in America is much larger than in Great Britain, and the American situation in this respect is much more serious. The less important are *Phomopsis lokoyae* [ibid., xiii, p. 200] on Douglas fir, *Aleurodiscus amorphus* [ibid., xiii, p. 608] and *Cephalosporium* sp. on *Abies* [ibid., xvi, p. 847], *Cytospora* sp. on spruce and poplar [ibid., xviii, p. 354], *Tympanis* sp. on pine [ibid., xviii, p. 217], and *Caliciopsis pinea* on pine [ibid., xv, p. 760], none of which occurs on trees in really good condition, while the *Nectria*

canker [ibid., xviii, p. 354] is both widespread and serious in the East.

With regard to quarantine legislation the author is inclined to think that periodical inspection and licence of the nurseries where export stocks are grown, and above all the selection and breeding of resistant strains, will do more in future to ensure the adequate protection of forests than the enforcing of new and stricter quarantine rules.

THOMPSON (G. E.). **A canker disease of Poplars caused by a species of Neofabraea.**—*Mycologia*, xxxi, 4, pp. 455–465, 3 figs., 1939.

Isolations from cankers on three- to six-year-old trees of *Populus grandidentata*, *P. tacamahacca*, and *P. tremuloides* observed in several parts of the Temagami Forest Reserve, Ontario, in 1930 and later, yielded a fungus described [with a Latin diagnosis] as *Neofabraea populi* n.sp. The disease first appears as small, depressed areas in the bark, frequently with a swelling at the margin and a vertical split in the centre of the lesions. Older cankers, ranging from 4 to 6 in. in length, are elliptical, girdling the stem with or without callus formation. In transverse section through a canker the wood is brownish, the discoloration often extending to the pith or some way along the annual rings.

The fungus is described as having mostly single, or some few confluent apothecia, scattered thickly over the dead bark; they are flesh-coloured to light brown and convex when fresh, becoming darker and flat to slightly concave when dry, fleshy to waxy in consistency, circular to irregular in outline, usually umbilicate, borne on a slight stroma about 100 to 150 μ thick, composed of loosely arranged, narrow-oblong to globose, hyaline hyphae, with the excipulum consisting of narrow, brownish, obliquely arranged hyphae; the asci are cylindrical-clavate, short-stalked, 80 to 112 μ by 9·5 to 12·5 μ, and contain eight irregularly biseriate, oblong-ellipsoid, straight to slightly curved, granular, hyaline, uni- to quadricellular ascospores, 16 to 22 by 5 to 6·5 μ; the paraphyses are filiform, 2 to 3 μ wide, hyaline, septate, simple or branched, slightly swollen at the tips, forming an epithecium. The conidial stage is a species of *Myxosporium* with conidiophores 25 to 35 by 4 μ, bearing cylindric-fusiform, straight or curved, conidia 25 to 45 by 4·5 to 5 μ.

Identical cultures were obtained from isolations of the fungus from ascospores, conidia, and tissue plantings of the diseased bark. The optimum temperature for growth in culture was approximately 18° C., some growth occurring at both 3° and 27°. Both single and poly-ascosporic isolations were found to produce apothecia after about 45 days' growth on maize meal agar at a temperature of 15°. The fungus was successfully inoculated into small trees of *P. grandidentata* and subsequently reisolated in pure culture.

KASAI (M.). **The staining fungus, Graphium rubrum Rumbold, on Chinese bandoline wood.**—*Ann. phytopath. Soc. Japan*, viii, 4, pp. 327–330, 3 figs., 1939. [Japanese. Abs. in *Biol. Abstr.*, xiii, 7, p. 1206, 1939.]

Particulars are given of the morphological and cultural characters of *Graphium rubrum* [*R.A.M.*, xiii, p. 555], the agent of a greyish staining of Chinese bandoline wood, *Machilus thunbergii*, this being the first

record both of the occurrence of the fungus in Japan and of its attack on the host in question.

Findlay (W. P. K.). **Effect of sap-stain on the properties of timber. II. Effect of sap-stain on the decay-resistance of Pine sapwood.**—*Forestry*, xiii, 1, pp. 59–67, 1 graph, 1939.

In further studies on blue stain of pine sapwood caused by *Ophiostoma coeruleum* (or *Ceratostomella coerulea*) [*R.A.M.*, xvii, p. 1], it was experimentally found that in most cases both naturally and artificially blue-stained sample blocks of Scots pine and Corsican pine (*Pinus nigra* var. *calabrica*) were more readily attacked by certain wood-destroying fungi (*Merulius lacrymans*, *Coniophora cerebella* [*C. puteana*], and *Poria vaillantii*) [ibid., xviii, p. 644] than clean ones, particularly when the staining fungus was dead. This was apparent from the slightly greater loss in weight from decay incurred in the former. In comparative tests blue-stained wood was found to absorb water more rapidly than clean material, and it is suggested that this greater porosity, which permits more rapid diffusion of the moisture and gases, and also of the enzymes produced by the fungi, may be the reason why the blue-stained wood is more readily attacked. There was no significant difference in the rate of drying of the blue-stained and the clean planks. It is pointed out in conclusion that since all sapwood has a low natural resistance to wood-destroying fungi, slight differences in this resistance are of no practical importance, and that from the point of view of natural durability the presence of blue stain need not be regarded as a serious defect.

Bose (S. R.). **Enzymes of wood-rotting fungi.**—*Ergebn. Enzymforsch.*, viii, pp. 267–276, 1939.

This is a summary of some outstanding contributions to the knowledge of the enzymatic properties of wood-destroying fungi.

Method of testing the toxicity of wood preservatives to fungi.—*Brit. Engng Stand. Ass.* (*Comm.*) [*Rep.*] 838, 17 pp., 2 diags., 1939.

Detailed directions are given for testing the toxicity of timber preservatives by the standard wood block method (recommended for adoption as the standard British method) [*R.A.M.*, xvii, p. 283 *et passim*), using *Coniophora cerebella* [*C. puteana*] (Idaweiche strain), *Lentinus lepideus*, and *Poria vaporaria* (Eberswalde strain) for trials on Scots pine sapwood and *Polystictus versicolor* for those on the outer wood of beech. In a test cited as an example of the evaluation of results, the toxic limits (toxic points), i.e., the interval between the concentration just permitting decay and that next highest in the series completely inhibiting it, for creosote (B[ritish] S[pecifications] type A) [ibid., xvi, p. 788] are given as 4 to 6, 4 to 8, about 12, and about 5 kg. per cu. m. for *C. puteana*, *Poria vaporaria*, *L. lepideus*, and *Polystictus versicolor*, respectively, the corresponding figures for sodium fluoride (excluding *P. versicolor*) being 0·5 to 0·7, 0·2 to 0·4, and about 0·1, respectively. Tested against *C. puteana*, 0·06 and 0·08 per cent. sodium fluoride preserved pine sapwood in a sound condition for four months at 22° C.

(the former concentration allowing slight superficial fungal growth), at 0·04 incipient decay set in (4·7 per cent. loss of dry weight), while the blocks in the 0·02 and control series were completely rotted (42 and 49·5 per cent. loss of weight, respectively).

DREFAHL (L. C.) & BESCHER (R. H.). **The effect of sodium dichromate on the preservative value of zinc chloride.**—*Proc. Amer. Wood Pres. Ass.*, xxxv, pp. 30–53, 5 graphs, 1939.

A full account is given of laboratory and outdoor service experiments in the control of the wood-destroying fungi *Coniophora cerebella* [*C. puteana*], *Lentinus lepideus*, and *Lenzites sepiaria* on southern yellow pine [*Pinus ponderosa*], Douglas fir [*Pseudotsuga taxifolia*], red oak [*Quercus* spp.], and gum [? *Liquidambar styraciflua*] with a combination of zinc chloride (81·5 per cent.) and sodium dichromate (18·5 per cent.), wood being impregnated with this mixture at the rate of ¾lb. per cu. ft. The results of the tests indicated that the combined treatment confers greater resistance to leaching, leaves a more toxic residue in leached wood, and extends the duration of serviceability in accelerated outdoor tests as compared with zinc chloride alone. Preservative methods are practically the same as for the latter, except that the temperature of the solution should not exceed 160° F. Corrosion was found to be materially reduced, both in respect of treating-plant equipment and hardware affixed to treated wood, by the use of the mixture instead of zinc chloride alone.

BRYAN (J.). **A new preservative.**—*Wood, Lond.*, iv, 4, pp. 161–162, 1939.

The admixture with a 1 per cent. solution of mercuric chloride of 2 per cent. potassium dichromate was shown in tests extending over a year at the Forest Products Research Laboratory, Princes Risborough, to reduce leaching to a negligible minimum without adversely affecting the toxicity of the former compound to *Lentinus lepideus* on Scots pine [*R.A.M.*, xviii, p. 426]. The further addition of sodium nitrite at the rate of 5 per cent. prevented the corrosion of metal containers. In order to obviate the reduction of the dichromate by the nitrite, it is necessary to adjust the solution to an alkaline reaction by the incorporation of 0·5 per cent. caustic soda.

BERTLEFF (V.). **Prüfung arsenhaltiger Holzschutzmittel.** [The testing of arsenic-containing wood preservatives.]—*Holz Roh- u. Werkstoff*, ii, 5, pp. 193–197, 3 figs., 1939.

A tabulated account is given of the writer's tests by the wood block (spruce and pine) method at Žilina, Czechoslovakia, of a new timber preservative, fluoran O. G. (Verein für chemische und metallurgische Produktion, Aussig a.d. E.), containing sodium fluoride, potassium dichromate, dinitrophenol, and sodium arsenate. The preparation does not corrode iron and conferred adequate protection against infection by various fungi at a concentration of 1 to 1·5 per cent. For practical purposes the use of a 2 per cent. solution (6 kg. per cu. m. pine wood) under vacuum may be recommended.

DAHLBERG (H. W.). **New Great Western leaf spot resistant varieties.**—*Proc. Amer. Soc. Sug. Beet Technol., 1939*, pp. 29–30, 1939 [Abs. in *Facts ab. Sug.*, xxxiv, 9, p. 55, 1939.]

Two new Great Western sugar beet selections, X Gr. 3719 and X Gr. 3720, demonstrated a very high degree of resistance to leaf spot [*Cercospora beticola*: see above, p. 777] in Colorado in 1938, when the disease was more severe than at any time during the preceding ten years, reaching a climax between 21st and 28th September.

NOLL (W.). **Untersuchungen über Fuss- und Welkekrankheiten bei Leguminosen.** [Studies on foot and wilt diseases in Leguminosae.]—*Z. PflKrankh.*, xlix, 6, pp. 385–431, 16 figs., 1939.

A detailed, tabulated account is given of the writer's studies at the Bonn Phytopathological Institute from 1935 to 1937 on the wilts and foot rots of Leguminosae, the material for examination being procured from various parts of Germany, supplemented by samples from Denmark and Holland. Garden and field peas affected by foot rot with occasional wilting yielded in pure culture on oatmeal or cherry agar *Ascochyta pinodella* [*R.A.M.*, xv, p. 273] (isolated 215 times out of 257 samples), *Mycosphaerella pinodes* [ibid., xviii, p. 237] (32), *Fusarium avenaceum* [ibid., xviii, p. 154] (25), *F. solani* (18), *F. oxysporum* [ibid., xiii, p. 613] (13), *Rhizoctonia* [*Corticium*] *solani* [ibid., xvii, p. 645] (12), and a number of other fungi (5 times or less). This form of the disease totally destroyed a pea stand at Odense, Denmark, in 1936, while infection percentages of 50 and 80 were observed in Württemberg and the Rhine Province, respectively. In a Rhenish field presenting quite a sound external appearance in 1937, 37 out of 89 plants in a row were found to be diseased; their average height was 40 cm. compared with 80 cm. for their healthy neighbours, which also bore five pods 6 to 7 cm. in length as against one or two of 4 to 6 cm. in the case of the infected material. Another form of foot rot, associated with conspicuous midsummer wilting, was found to be predominantly due to *F.* spp., especially *F. solani* (isolated 46 times from one lot and 66 from another), *C. solani* (12 and 14), and *A. pinodella* (16 and 6). From 27 samples of pea plants affected by wilting of the central cylinder without foot rot *F. solani* was isolated 16 times, *C. solani* 8, *P. de Baryanum* 7, and *A. pinodella* once.

C. solani and *P. de Baryanum* were each isolated three times and *F. avenaceum* once from Dutch broad beans (*Vicia faba*) showing foot rot symptoms without wilt. Ten samples from Bonn (1936) yielded *C. solani* ten times, *F. orthoceras* four, and *F. avenaceum* three, while from twelve from the same locality (1937) *F. oxysporum* was isolated ten times, *P. de Baryanum* three, and *F. avenaceum* and *Calonectria graminicola* var. *neglecta* once each. The results of further tests on 52 German samples indicated that *Corticium solani, P. de Baryanum*, and *F. orthoceras* are much more prominent on the root system than at the stem base; the latter site yielded *A. pinodella* in five instances, *F. solani* in eight, and *Calonectria graminicola* var. *neglecta* in seven.

Twenty German samples of vetches gave rise in eight isolations to *F. oxysporum*, in seven to *F. avenaceum*, while *C. graminicola* var. *neglecta*

and *Corticium solani* developed six times each; *Vicia narbonensis* was infected by *C. solani* and *F. orthoceras* (five each).

Of two consignments of diseased (combined wilt and foot rot) lupin (*Lupinus angustifolius*) material from Bonn (1936 and 1937), the former yielded predominantly *C. solani* [ibid., xviii, p. 116] and the latter *F. oxysporum* [loc. cit.]. Isolations from 97 samples of tap-roots and stem bases of diverse origin included *F. oxysporum*, *P. de Baryanum*, *C. solani*, *F. solani*, *F. avenaceum*, and *A. pinodella* (27, 22, 21, 18, 11, and 9 times), besides other *F.* spp. and miscellaneous fungi.

From 29 samples of soy-bean plants killed by wilt and foot rot near Cologne in 1937 *F. oxysporum* was isolated 27 times; other fungi implicated in the disease included *C. solani*, various species of *Fusarium*, and *A. pinodella*.

Inoculation experiments were carried out with *A. pinodella*, *M. pinodes*, *A. pisi* [ibid., xvii, pp. 427, 432] (for comparative purposes), *Corticium solani*, *F. solani*, *F. oxysporum*, *F. orthoceras*, and an unidentified *F.* sp. from *L. luteus*, the inoculum being introduced into the soil, while in the case of *A. pinodella* the plants were also sprayed with conidial suspensions and the seed was immersed in these for 24 hours before planting. All three strains of *A. pinodella* (from peas, broad beans, and soy-beans) were pathogenic to the same three hosts, peas being uniformly the most severely infected and soy-beans the least. In another test on garden peas, strains from field peas, broad beans, *L. angustifolius*, and soy-beans were equally virulent. Similar, though less extensive, injuries were produced by *M. pinodes* in cross-inoculations on peas (garden and field), *L. angustifolius*, *L. luteus*, broad beans, and *V. villosa*. *A. pisi*, on the other hand, was practically innocuous to peas.

Most of the legume strains of *C. solani* were highly pathogenic to their own hosts and the other test plants, those from pea, *L. angustifolius*, and *V. narbonensis* being particularly aggressive. A strain isolated from cabbage was very destructive to broad beans, vetch, and *L. angustifolius* and moderately so to peas, while two from potato [ibid., xv, p. 586 *et passim*] were generally harmless, though one caused heavy damage on *L. angustifolius*. The infective capacity of species of *Fusarium* was much slighter than that of *C. solani*, some strains of *F. solani*, in fact, being non-pathogenic. Both *C. solani* and *F.* spp., however, consistently induced the reddish-brown discoloration of the central cylinder which was absent in the material inoculated with members of the *Ascochyta* group.

Union of South Africa. Proclamation 155 of 1939. Restrictions on the importation of Potatoes.

From and after 1st February, 1940, the Union of South Africa Proclamation 286 of 1936 [*R.A.M.*, xvi, p. 640] is amended to prohibit the introduction into the Union from overseas, Portuguese East Africa, South West Africa, or any place in Africa north of the Zambesi, except Northern Rhodesia, Nyasaland, and the Belgian Congo of any consignment of potatoes unless certified in the country of origin as officially inspected in the field, as sufficiently free from virus diseases to be suitable for seed purposes, and as not grown in the vicinity of unhealthy potatoes or other plants affected with potato virus diseases.

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